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CHARLES ELMORE

Supreme Court of the United States

OCTOBER TERM, 1930.

No. 19.

LEKTOPHONE CORPORATION,
Petitioner,

vs.

THE ROLA COMPANY,
Respondent.

BRIEF FOR PETITIONER.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

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INDEX.

	PAGE
Jurisdiction	1
Brief Statement of the Case	3
The Nature of the Invention	3
The Element of Defendant's Structure That Gives Rise to the Conflict of Authority	4
The Issue	5
Summary of Argument	7
Argument:	
The Subject Matter Patented	8
The Idea of Means	9
The Mode of Operation and Functional Relationship of the Three Elements	14
The Result	16
The Claims	17
Defendant's Structure	18
The Relation of the Hopkins Invention to the Prior Art	21
1. Starling & Cole	21
2. Classification of Patents Relied on by Defendant	25
The Flat Sounding Board Patents	26
French patent to Ader 127,180 of 1878.	
British patent to Lodge 9,712 of 1898.	
U. S. patent to Shanks 822,024.	
U. S. patent to Lumiere 986,477.	
U. S. patent to Lumiere 1,036,529.	

PAGE

The Sound Box and Horn Combination Patents... 30
U. S. patent to Kraemer 890,142.
U. S. patent to Edison 963,362.
U. S. patent to English 1,064,062.
U. S. patent to Brown 1,096,676.
U. S. patent to Johnson 1,180,461.
U. S. patent to Elfering 1,182,078.
U. S. patent to English 1,192,289.
British patent to Stroh 9,418 of 1899.
British patent to Stroh 3,393 of 1901.
British patent to Brown 29,833 of 1910.
British patent to Brown 1,157 of 1911.

The Maxwell Mechanical Telephone Patent 33
The Dann & Lapp Telephone Transmitter Patent 36
The Rogers Electrical Telephone Transmitter Patent (footnote, p. 22) 22, 26

The Nature of Hopkins' Inventive Act Looked at From the Point of View of the Prior Art 36
Is the Defendant's Structure Excluded From the Monopoly by the Disclosure of the Specification and the Patent Office Proceedings? 40

Estoppel 42
Changes Made in Claim Language as to the Rim 42
Changes Made in Claim Language as to Size 43

Interpretation 46

Things Said in Argument with Respect to Size 51

The Proper Test of Infringement 63

The Decision and the Opinion of the Court of Appeals in the Instant Case 65
The Fundamental Error 68
Conclusion 71

INDEX OF CASES CITED.

PAGES

Alice State Bank vs. Houston Pasture Co., 247 U. S., 240 3
American Cone & Wafer Co. vs. Denaro, 297 Fed., 913 41
Boyer vs. Keller Tool Co., 127 Fed., 130 41
W. F. Burns Co. vs. Automatic, 241 Fed., 472 41
Cartridge vs. Cartridge, 112 U. S., 624 40
Computing, etc., Co. vs. Automatic Scale Co., 204 U. S., 609 40
Concrete Appliances Co. vs. Meinken, 262 Fed., 958 39
Continental, etc., Co. vs. Eastern, 202 U. S., 415 ..... 69, 70
Corbin vs. Eagle Lock, 150 U. S., 38 40
Crawford vs. Heysinger, 123 U. S., 589 40
Crown Cork & Seal Co. vs. Sterling, etc., Co., 217 Fed., 381 39
Dobson vs. Lees, 137 U. S., 258 40
Eibel Co. vs. Paper Co., 261 U. S., 45 70
Fullerton Walnut Growers Assn. vs. Anderson, 166 Fed., 443 41
Goodyear, etc., Co. vs. Davis, 102 U. S., 222 ..... 40, 41
R. Hoe & Co. vs. Goff Press Co., 30 F. (2d), 275 41
Hubbard vs. Tod, 171 U. S., 474 3
Hubbell vs. U. S., 179 U. S., 78 40
I. T. S. Co. vs. Essex Co., 272 U. S., 429 40
Knapp vs. Morss, 150 U. S., 221 40
Kokomo, etc., Co. vs. Kitselman, 189 U. S., 8 40
Leggett vs. Avery, 101 U. S., 256 40
Lehigh, etc., Co. vs. Kearney, 158 U. S., 461 40
Lektophone Corp. vs. Brandes (D. C., Dist. N. J.), 16 F. (2d), 934 27
Lektophone Corp. vs. Brandes (C. C. A., 3), 20 F. (2d), 155 ..... 1, 2, 4, 6, 11, 23
Lektophone Corp. vs. Colonial (D. C., E. D., N. Y.), unreported 24, 29

PAGES

Lektophone Corp. vs. Miller Bros. (D. C., Dist. Del.), 37 F. (2d), 580 ..... 2, 3
Lektophone Corp. vs. Rola Co. (C. C. A., 9), 34 Fed. (2d), 764 ..... 5, 6, 24, 65-70
Lektophone Corp. vs. Sylo, etc., Co. (D. C., E. D., N. Y.), 11 F. (2d), 421 ..... 26, 30, 35, 39
Lektophone Corp. vs. Western Electric (D. C., S. D., N. Y.), 20 F. (2d), 150 ..... 22, 23, 27, 31, 38
McCarty vs. Lehigh, etc., Co., 160 U. S., 110 40
McCormick, etc., Co. vs. Medusa, 222 Fed., 288 41
Machine Co. vs. Murphy, 97 U. S., 120 ..... 21, 63
Mahn vs. Harwood, 112 U. S., 354 40
Miller vs. Eagle, 151 U. S., 134 69
J. A. Mohr & Son vs. Alliance, etc., Co., 14 F. (2d), 793; affirmed 14 F. (2d), 799 41
Montana Mining Co. vs. St. Louis, 186 U. S., 31 3
Morgan, etc., Co. vs. Albany, etc., Co., 152 U. S. 425 40
Pangborn Corp. vs. W. W. Sly Mfg. Co., 284 Fed., 217 41
Phoenix, etc., Co. vs. Spiegel, 133 U. S., 360 40
Roemer vs. Peddie, 132 U. S., 313 40
Royer vs. Coupe, 146 U. S., 524 40
Sanitary Refrigerating Co. vs. Winters, 280 U. S., 30 ..... 3, 21
Sargent vs. Hall, 114 U. S., 63 40
Sewall vs. Jones, 91 U. S., 171 61
Shepard vs. Carrigan, 116 U. S., 593 40
Singer Co. vs. Cramer, 192 U. S., 265 40
Sutter vs. Robinson, 119 U. S., 530 40
Temco vs. Apco, 275 U. S., 319 ..... 21, 70
Watson vs. Cincinnati Ry. Co., 132 U. S., 161 40
Weber, etc., Co. vs. Freeman, etc., Co., 256 U. S., 668 40
Westinghouse, etc., Co. vs. Boyden, etc., Co., 170 U. S., 537 ..... 40, 42, 63
Winans vs. Denmead, 15 How., 330 ..... 21, 61, 63

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No. 19.

LEKTOPHONE CORPORATION,
Petitioner-Plaintiff,

VS.

THE ROLA COMPANY,
Respondent-Defendant.

BRIEF FOR PETITIONER.

(Plaintiff Below.)

Jurisdiction.

The case (No. 19) comes to this Court from the Circuit Court of Appeals for the Ninth Circuit on a writ of certiorari, granted January 27, 1930, on petition of plaintiff below, because of conflict between the decision of that Court (34 Fed. [2d], 764; and Tr., 172) and the decision of the Court of Appeals for the Third Circuit in *Lektophone Corporation* vs. *Brandes Products Corporation* (20 Fed. [2d], 155, and pamphlet, p. 55) as to the scope

of patent No. 1,271,529, granted July 2, 1918, to Hopkins for an "Acoustic Device"*.

After the issuance of the writ of certiorari in the instant case, this Court, on May 5, 1930, on petition of defendant Miller Bros., issued a writ of certiorari to the Court of Appeals for the Third Circuit in *Miller Bros.* vs. *Lektophone Corporation* (37 F. [2d], 580; pamphlet, p. 108), and on joint motion of the parties that case (No. 68), has been advanced and assigned for hearing following the instant case.

The *Miller case* arose in the District of Delaware before Judge Morris who, on January 23, 1930, held that the issues and the evidence in the *Miller case* differ in no substantial particulars from those in the *Brandes case* and decreed for plaintiff on that authority. An appeal was immediately perfected to the Court of Appeals for the Third Circuit and this Court was petitioned to issue and did issue a writ of certiorari before the Circuit Court of Appeals passed on the case.

In the instant case, the Circuit Court of Appeals of the Ninth Circuit found it unnecessary to pass upon the validity of the patent (Opinion, Tr., 130), which had been affirmed in the *Brandes case* and elsewhere. The Court rested its decision on the holding of non-infringement (Opinion, Tr., 132).** Under these circumstances valid-

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*The patent has been much litigated in this country and the corresponding patent has been much litigated abroad. The validity of the patent has repeatedly been affirmed by the courts in this country and abroad. Accused devices of different forms have been adjudicated. Some have been held to infringe and others have been held not to infringe. All these opinions have been printed in a pamphlet entitled "Lektophone Litigation—Opinions and Decrees" which will be filed with this brief, and herein cited as—pamphlet, page .....

**The ground assigned for the petition of certiorari was that

> "A conflict as to the scope of patent claims, on substantially the same evidence of prior art and substantially the same type of accused device, exists between the Court of Appeals for the Ninth Circuit and the Court of Appeals for the Third Circuit" (Petition, p. 1).

ity will not be reviewed in the instant case, as we understand it;* although the state of the art will be considered in determining the scope of the patent.

In the *Miller case* (No. 68) validity is, we suppose, at least nominally in issue in addition to the question of infringement.

Brief Statement of the Case.

The Nature of the Invention.

1. The patented loudspeaker was conceived prior to June 14, 1913, when the phonograph or talking machine art used the sound-box and horn combination familiar in the early exposed-horn phonographs and later in the cabinet phonographs of the "Victrola" type. To escape the sound distortions, particularly in the horn or trumpet, the inventor sought directly to regenerate or recreate sounds without the interposition of a confined body of air as in the old sound-box; and without the employment of a restrictive transformer such as the old horn or trumpet.

2. He developed for this purpose a large, light, stiff paper cone, coupled by an annular plane peripheral rim to a rigid encircling frame—a simple three-element mechanical combination.

3. The law of cooperative action of the three elements of this mechanical combination is that vibrations of sound frequencies impressed upon the apex of the large, light, stiff paper cone move the cone bodily to impart the sound waves directly to a large body of air, the rigid

Alice State Bank vs. *Houston Pasture Co.*, 247 U. S., 240; *Montana Mining Co.* vs. *St. Louis*, 186 U. S., 31; *Hubbard* vs. *Tod*; 171 U. S., 474, and *Sanitary Refrigerating Co.* vs. *Winters*, 280 U. S., 30.

encircling frame affords mechanical support and protection for the whole structure, and the interposed plane peripheral rim yields sufficiently to permit the bodily sound-producing movement of the large, stiff cone, resisting, however, excessive displacement and deformation of the periphery of the cone.

Lightness, stiffness and large area are the essential characteristics of the sound-producing conical portion of the structure, **yielding flexibility** is the essential characteristic of the interposed rim, and **rigidity** is the essential characteristic of the annular frame.

In the *Brandes case*, the Circuit Court of Appeals of the Third Circuit said (pamphlet, pp. 56-57):

> "Previous to the use of the now common cone sounding board, the horn was the usual mode of giving out sound. * * *
>
> To our minds Hopkins was the first to make the combination of a conical-shaped paper device of proper size provided with flexible edges coupled to a rigid frame used in free air. All of these three elements in free air, the light conical sounding-board of specified area, the flexible edge and the rigid frame, combine to reproduce pure low notes. The device has come into general use, and its licensees are now supplying the public needs."

The Element of Defendant's Structure That Gives Rise to the Conflict of Authority.

Defendant's loudspeaker (Pltff.'s Ex. 3) has the large light paper cone of the specified area, the rigid annular frame, and the interposed flexible rim. The **sole** difference from Hopkins' specific disclosure lies in the rim. Where Hopkins' specific disclosure shows a paper rim

constituting a plane peripheral extension of the cone, defendant uses a narrower rim of more flexible material—soft kid leather.

In the *Brandes case*, precisely the same situation existed. There, defendant's narrower rim was made of thin rubber.* The conflict was expressed in the following words in the opinion of the Court of Appeals of the Ninth Circuit (Tr., 130-131):

> "* * * we cannot follow the latter decision [the *Brandes* decision] in so far as it holds that a flexible, non-resonant rim or annulus connecting the cone of the diaphragm to the stationary metal rim is the equivalent in a sound-reproducing device of the flat rim or plane annulus of Hopkins' tympanum. * * *."

The Issue.

Thus the sole issue here is whether this substitution of a narrower rim of more flexible material avoids the Hopkins patent.

Specified area is important in the patented invention. Defendant retains the specified area of the light conical sounding board. The area (width) of the flexible rim is important only as it affects the flexibility of the rim. Compared with the plane peripheral extension of the paper cone specifically disclosed in the Hopkins patent, defendant's rim is narrower. But the narrowing of defendant's rim, which tends to decrease flexibility, is offset by the use of a more flexible material. Upon this compensated departure from the literal disclosure of the specific embodiment in the Hopkins patent defendant's whole argument of non-infringement is based. **No other difference between the two structures exists.**

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*Pltf.'s Ex. 27, Tr., 104 and 106.

It was contended in both Courts of Appeals (a) that the state of the art requires a limitation of the Hopkins patent to the specific form of plane peripheral paper rim illustrated, and (b) that by the language of the specification and the representations made in argument by the patentee or on his behalf when the application was pending in the Patent Office, plaintiff is estopped to cover any other form of rim.

The Court of Appeals for the Third Circuit rejected all defendant's contentions.

The Court of Appeals for the Ninth Circuit rejected the argument for estoppel, saying (Tr., p. 129):

> "The representations or arguments of the patentee in the patent proceedings do not under the circumstances here disclosed constitute an estoppel. American Cone & Wafer Co. vs. Denaro, 297 Fed., 913; Fullerton Walnut Growers Assn. vs. Anderson Barngrover Mfg. Co., 166 Fed., 443; R. Hoe vs. Goss Printing Press Co., 30 Fed., 2nd, 271-275."

But that Court sustained the contention as to limitation by the prior art, expressing its inability to agree with the Court of Appeals for the Third Circuit (*ante*, p. 5) and saying (Tr., 132):

> "We must either hold that the appellant's device is void for lack of invention or that he is so narrowly confined by the specified dimensions and claims of his patent that the smaller device of the appellee, with its limp leather annulus, does not infringe. It is sufficient for the purpose of this case to follow the latter course, as the Trial Judge did."

SUMMARY OF ARGUMENT.

1. The Hopkins device is a three-element mechanical combination comprising a large, light, stiff paper cone, coupled by an annular plane peripheral rim to a rigid encircling frame, resulting in a practical direct-acting loudspeaker having a new mode of operation and a new result.

2. Defendant has copied that structure, making only a colorable departure therefrom by substituting for the plane peripheral extension of the cone a narrower rim whose desirable flexibility is retained by making it of more flexible material.

3. Comparison of the patented device with the prior art shows that the invention lay in the new combination, not in the selection of the rim material, which was already old and the material of which is nowise essential so long as its flexibility is preserved.

4. Neither the disclosure of the specification nor the patent office proceedings limit the broad language of the claims to a rim which is an integral plane peripheral extension of the cone, or otherwise exclude defendant's structure.

5. On the contrary, change in claim language during the prosecution evidences the patentee's determination, in which the patent office examiner acquiesced, (a) that the monopoly should not be limited to a rim which is an annular plane peripheral extension of the cone, and (b) that it should not be limited to exclude equivalent structures in which the overall diameter might be literally less but not substantially less than nine inches.

6. In estimating the range of equivalents to which the patent is entitled, the Court of Appeals in the instant case fell into the error repudiated by this Court in the Paper Bag case (Continental, etc., Co. vs. Eastern, 202 U. S., 405, 415).

ARGUMENT.

The Subject Matter Patented.

The Object.

The stated object of the invention is the direct propagation of sound waves of correct intensity, amplitude, pitch and timbre on free air, as distinguished from the indirect production of sounds by means of a "reproducer or sound-box and horn" commonly used for sound production prior to Hopkins' invention (Pat., p. 1, lines 12, et seq., Tr., 134).

The patentee explains (Pat., p. 1, lines 27-66, Tr., 135) that in the usual sound-box and horn combination, when the diaphragm (which is one wall of a small casing called a sound-box) is vibrated, it sets up in the confined air in the sound-box, waves or impulses of high-pressure and small-area. The high-pressure small-area impulses thus generated within the sound-box are not waves having the proper self-sustaining form to travel through the air to the listener's ear and there produce sounds which are an accurate reproduction of the original sounds. This is evidenced by the squeaky sounds made by a phonograph sound-box when its horn is removed. These impulses were, therefore, in this old sound-box and horn combination led out from the sound-box through a small opening in the wall opposite the diaphragm into the throat of a horn which transformed the high-pressure, small-area impulses into low-pressure, large-area self-sustaining sound waves. This combination of sound-box

and horn introduced certain "distortions of the true recorded sounds in the reproducer, and more particularly in the horn or amplifier, giving rise to those characteristic sounds known as phonograph and horn sounds" (Pat., p. 1, lines 52-57, Tr., 135).

Differentiating his invention in principle and purpose from this old sound-box and horn combination, the patentee says: (Pat., p. 1, lines 67, et seq., Tr., 135) that the direct acting sound producer of his invention directly propagates the sounds on free air "without the interposition of a confined body of air and without the employment of a restrictive transformer such as a horn," thereby eliminating the undesirable distortions and obtaining direct propagation in free air of sound waves of an intensity and amplitude substantially corresponding to the original sound waves.

The Idea of Means.

The means devised by the inventor for effecting his stated purpose are then indicated generally in the patent as follows (p. 1, lines 94-102, Tr., 136):

> "The invention consists, briefly, in the provision of a tympanum of novel construction, which is capable of responding to the high frequency vibrations employed in the reproduction of sounds, and of imparting these vibrations to a large body of air; and it is to be considered as a division of the invention shown and described in my prior application,* renewed March 22, 1918, No. 224,048."

Proceeding to a description of his preferred embodiment of the invention, the patentee says (p. 2, lines 72-79, Tr., 137):

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*This parent application became patent 1,271,527. See file wrapper, Pltf.'s Ex. 7, Tr., 192, et seq., and patent 1,271,527, Tr., 287, et seq.

"The tympanum L, which forms the subject of the present case, is constructed of light, vibratile material and has an annular plane peripheral portion or supporting rim *l*, the outer edge of which is tightly gripped and rigidly supported between the rings K,K′, and a central conical portion *l′* rising from the inner edge of the said rim *l*."

The function of the plane peripheral portion *l* of the tympanum and its cooperative relationship to the other elements, is stated in the parent application (Pltf.'s Ex. 7, Tr., 204) as follows:

"The plane peripheral portion *l* of the tympanum maintains the place of the conical active portion of the tympanum and yields sufficiently to permit of the required motion of the conical portion resisting, however, displacement of the conical portion in just that degree necessary to maintain the form and neutral position of the active conical portion."

It will be seen that this is a simple mechanical combination of three elements, (1) the central conical portion *l′* of the tympanum which is the effective sound producer, (2) the plane peripheral portion *l* of the tympanum which yieldingly connects the conical portion to the rigid frame, and (3) the rigid frame consisting of the rings K,K′.

The above quoted statement of the essential three-element structure is followed in the patent by the following statement as to the size necessary for satisfactory regeneration of sounds (patent, p. 2, lines 79-103, Tr., pp. 137-138).

"If satisfactory regeneration of sounds from a record or other sound-vibrated element is to be had, the whole diameter of the tympanum, that is, the diameter of the aperture in the rings K, K′ should exceed nine inches in order that the condition required to regenerate the sound waves in the man-

ner above described shall be fulfilled. The base of the central conical portion *l'* should exceed in area one-half of the effective area of the entire tympanum, that is, the area of the aperture in the rings K, K'; or in other words, the diameter of the base of said conical portion should be at least eight-tenths of the diameter of the said aperture. The altitude of the conical portion *l'* should be at least one-quarter of the diameter of its base.

"It is, of course, possible to make some variation from the approximate sizes given without materially altering the result; but if the tympanum is constructed as shown in the drawing, any great variation from these proportions will be found to affect the character of the reproduction."

It is important to understand how size affects the character of the reproduction. It is not at all a matter of choosing a large size to make a louder sound. It is a question of the correct reproduction of the musical pitch and timbre, not a question of volume of sound.

Correct pitch and timbre demand recreation, in even balance, of all the sound frequencies that are important in speech and music. Frequencies vary from about 100 cycles per second up to about 5,000 cycles per second. The wave length of a high pitched note of 5,000 cycles per second is three and one-half inches. The wave length of a low pitched note of 100 cycles per second is eleven feet (Hazeltine, Tr., 25). The area of the sound emitting surface must bear some reasonable relation to the wave length of the emitted sound.* Theoretically, the radiating sur-

*It is a highly valuable, and unforeseeable, advantage of Hopkins' light stiff paper cone of adequate area that it adapts itself to sound vibrations of all important frequencies. Higher frequencies are shed or emitted from near the apex and as the waves become of lower frequency they are emitted from greater areas. That effect was commented upon by the Circuit Court of Appeals for the Third Circuit in the *Brandes case* (Pamphlet, p. 57).

face should be about one-third of the wave length. In the sound-box and horn combination the diameter of the sound-box diaphragm was about one inch (Hazeltine, Tr., 26). The area of the aperture in the sound-box at the base of the horn was a fraction of an inch (Tr., 25). The taper in the horn or trumpet of gradually increasing cross-sectional area was introduced to permit a gradual expansion of the wave to the necessary larger area before it was released upon the air. For the lower frequencies the mouth of the ordinary horn should theoretically be about four feet in diameter, but this was objectionably large and the ordinary horns had a mouth diameter of less than a foot. To effect an equivalently balanced reproduction of the sounds over the entire frequency range, Hopkins taught that the base area of his conical sounding-board should be not less than half the area of a tympanum (cone plus rim) nine inches in diameter. For the purpose of the present case that may be taken to be a cone having a minimum basal diameter of 7.2 inches—eight-tenths of nine inches.* Compared with the one inch diaphragm commonly used in the old phonograph sound-boxes that affords a minimum area approximately fifty-two times as large. This enlargement enabled Hopkins to do away with the horn and its accompanying distortions without sacrificing balance of the high and low notes (See Hazeltine, Tr., 25-27).

The patentee then says (p. 2, lines 103-124, Tr., 138):

> "It is of vital importance that the tympanum be made of crisp, strong material, having considerable

*The statement in the Hopkins patent that a cone having a basal diameter eight-tenths of the diameter of the entire tympanum is, "in other words," a cone having an area one-half of the area of the entire tympanum, is not mathematically accurate. The areas are related to one another as the squares of the diameters, and a cone having a basal diameter of 6.36 inches would have a base area one-half the area of the entire tympanum 9 inches in diameter.

rigidity within itself, and it is also of vital importance that the tympanum as a whole be extremely light and have as little inertia as possible without a weakening effect. The tympanum is shown of conical form* with a smooth surface, and this has been found to be very satisfactory. The conical shape is given the tympanum so that shocks or vibrations impressed upon the apex of the cone in a direction toward its base will *move the whole cone bodily*, the strains being imparted edgewise of the material and no wave motions being set up in the thin material of the cone. The curvature of the walls of the cone precludes the setting up of waves in the material; *and the intended object, a simultaneous movement of the whole conical portion of the tympanum, is thus attained.*" (Emphasis ours.)

With respect to the rim portion of the tympanum, the patentee then says (p. 2, line 124 to p. 3, line 1, Tr., 138):

> "While I prefer to construct the tympanum in the form described and shown with a smooth surface, especially in view of the ease of construction, yet it is possible to form radial or concentric corrugations in the plane peripheral portion *l* and produce a light, stiff and very satisfactory article for the purpose."

It is plain that if the rim is made with radial corrugations it will be stiffer for a given width and a given thickness of material, and that if it is constructed with concentric corrugations, it will be more flexible for a

*In this and the following sentence Hopkins applies the word "tympanum" to the conical portion alone. In the description of the tympanum itself (p. 2, lines 72-79, *ante*, p. 10) and in the claims it is used to define the cone plus the rim.

given width and a given thickness of material (Hopkins, Tr., 75).

The patentee's disclosure, so far as it has to do with the acoustic device "which forms the subject of the present case" (Pat., p. 2, line 72) is then completed by the statement (p. 3, lines 6-12, Tr., 138):

> "The tympanum should preferably be constructed of a colloidal substance, and should be from 3 to 20 thousandths of an inch in thickness according to the crispness or stiff character of the material used. Compressed fibrous material, such as hot pressed paper or fiber, has been found to act satisfactorily."

This statement defines the paper cone material used by this defendant, as well as by Brandes and by Miller.

The Mode of Operation and Functional Relationship of the Three Elements.

Vibrations are impressed upon the apex of the cone *l'*. The vibrated cone directly imparts these vibrations to a large body of unconfined air. There is no confining of a small body of air in a sound-box and subsequent transformation of the violent disturbances by means of a horn as in the sound-box horn combinations of the old art. The inertia of the large light paper cone is very small so that it is capable of responding to the high frequency vibrations employed in the reproduction of sounds. Its conical shape provides stiffness in the direction of the axis of the cone so that when vibrations are impressed upon its apex, they "will move the whole cone bodily," and, "the intended object, a simultaneous movement of the whole conical portion of the tympanum, is thus attained."

Like vibrations impressed upon a disk of paper of the same weight would move only a small area near the

center, bending the paper but not effectively imparting sound waves to the air.

Although the paper cone is much more rigid than would be a flat sheet of paper, yet it is not absolutely rigid; and it is less rigid at the periphery than at the apex. If sound-producing vibrations were impressed upon such a paper cone left free at its peripheral edge there would result a weaving or fluttering of the edge which would give rise to rasping noises of the paper referred to as "blasting."* If, on the other hand, the rings K,K′, were so shaped and applied as to clamp the edge of the cone itself, that would prevent the desired bodily movement of the cone and greatly reduce the sound-producing motion thereof.**

So the inventor introduced between the mechanical framework of the device constituted by the rings K,K′ and the vibrating cone itself, the plane peripheral portion or supporting rim *l* which **yieldingly** holds the vibrating cone in position, permitting the required sound-producing bodily motion of the conical portion, yet sufficiently resisting displacement to prevent the deformation of the peripheral edge of the cone which would cause the blasting noises.

The **rigid** frame and flexible annular rim not only convert the cone *per se* from an impractical and unsuccessful sound regenerating device into a thoroughly practical and successful one from an acoustical standpoint but they also make the loudspeaker a practical and successful one from a mechanical and commercial standpoint because the rigid frame furnishes protection to the cone and gives strength and stability to the device. These mechanical and commercial advantages are obtained without sacrificing any acoustical advantages because the interposed

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*Plaintiff's expert Hazeltine, Tr., 27-28; defendant's expert Tenny, Tr., 65; Hopkins, Tr., 74; Demonstration by Hazeltine, Tr., 95.

**Hazeltine, Tr., 28; Tenny, Tr., 65-66; Hopkins, Tr., 76.

annular rim yieldingly connects the frame and the cone so as to avoid the damping that would result from directly connecting the frame to the cone and at the same time avoids the acoustical imperfections of a free edge cone, i. e., a cone whose edge is uncontrolled.

While the propagation of the sound waves in the air, generally speaking, is a function of the large, light, stiff paper cone *per se,* nevertheless the **efficient** propagation of the sound waves in the manner contemplated by the patent is the result of the simple and very definite coaction of the three elements of the combination. It is the functional relationship between the conical active portion and the flexible rim, on the one hand, and between the flexible rim and the rigid frame, on the other hand, that "maintains the place of the conical active portion" (Pltff.'s Ex. 7, Tr., 204) and causes the flexible rim to "maintain the form" of the base of the cone and thereby prevent weaving or fluttering of the edge of the cone, while at the same time the flexible rim "yields sufficiently to permit of the required motion of the conical portion" (Tr., 204).

The Result.

By these three elements in combination, functionally related as above described, the patentee's stated object was so far attained as to bring within the reach of the purchasing public for the first time a satisfactory direct-acting sound producer; an object which had engaged the attention of inventors and patentees for many years, but which had not previously been practically attained. The invention was made and marketed during the old days of the phonograph, before the advent of radio broadcasting and radio loudspeakers. In the old phonograph days, sound reproduction was effected entirely by means of the sound-box and horn combination, the horn being either

exposed to view or enclosed within the phonograph cabinet, and in the early days of the radio, the sound-box and horn combination was generally used for sound reproduction. Today the sound-box and horn combination is used only in improved, highly developed and expensive form.* We see on every hand in the shops and in the homes of America direct-acting loudspeakers of the paper cone type.

It is plaintiff's position that this three-element combination invented and patented by Mr. Hopkins was the first practical loudspeaker of the direct-acting type; that it was an important contribution which turned the art of loudspeakers into a new channel of development and is directly responsible for the large cone speaker industry of today.

The Claims.

The broadest claims, which read literally on defendant's structure, are claims 4 and 8, as follows:

> "4. An acoustic device, comprising a tympanum support having a circular aperture, and a light tympanum** freely exposed to unconfined air and having its outer edge rigidly mounted on said support in said aperture; said tympanum having a central conical portion, the base of which exceeds in area one-half the effective area of the said tympanum; the tympanum being of sufficient area to impart to the surrounding free air, when vibrated, sound waves substantially corresponding in intensity to the original sound waves.

*Tenny, Tr., 60-61.

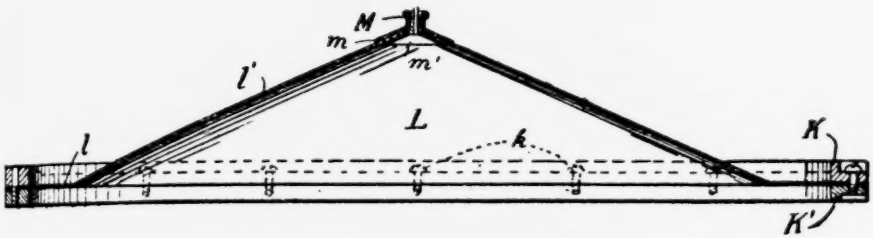
**Note that the word "tympanum" is here used to embrace the two elements (1) the "central conical portion" and (2) the "annular plane peripheral portion or supporting rim."

8. An acoustic device, comprising a tympanum embodying a bodily movable, central conical portion, and an annular rim which encircles said conical portion and which is rigidly supported, said conical portion being freely exposed on all sides to unconfined air and being of sufficient area to produce self-sustaining sound waves in the surrounding air when vibrated, substantially as described."

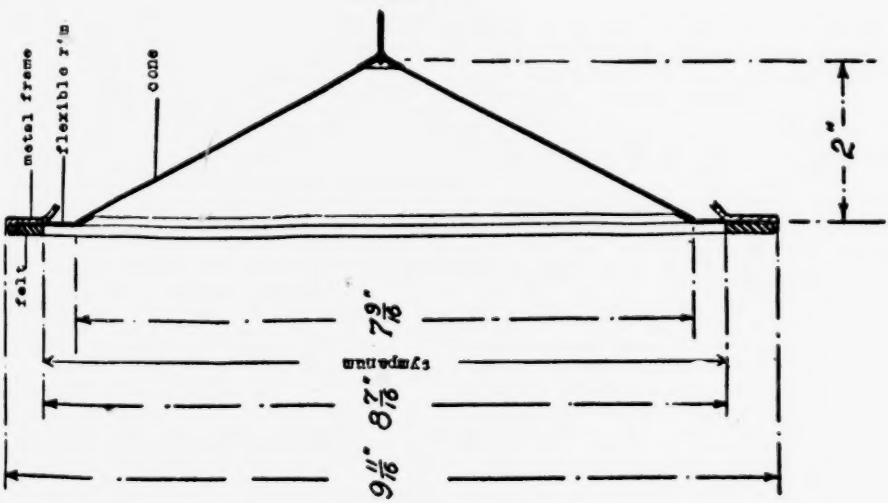
Defendant's Structure.

That defendant's loudspeaker (Pltf.'s Ex. 3) has the three elements of the Hopkins invention, i. e., (1) a direct acting paper cone of sufficient area to impart to the surrounding free air when vibrated, sound waves substantially corresponding in intensity to the original sound waves, (2) a rigid metal frame, and (3) the interposed flexible rim, is immediately apparent upon looking at it; or upon comparing the drawing of the patent with the drawing of defendant's device (Tr., 158) both printed on the opposite page.

HOPKINS



ROLA



Area of tympanum = 55.95 sq. in.
Area of base of cone = 44.90 sq. in.

The three elements of defendant's device have the same functional relationship as the elements of the patented device. The cone has the large area, the lightness and the stiffness required. The rim has sufficient flexibility to permit the bodily sound-producing movement of the cone, and yet is effective to prevent the blasting that a free-edge cone would suffer from*. The annular frame has rigidity to serve as a mechanical support and protection for the entire structure.

In defendant's structure the cone has a base diameter greater than eight-tenths of nine inches so that defend-

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*Plaintiff's expert Hazeltine said (Tr., 29):

> "I believe the mode of operation of defendant's loudspeaker is just the same as the mode of operation described in the Hopkins patent."

Defendant's expert Tenny said (Tr., 65-66):

> "Q. Why don't you support your cone by a rigid frame clamped directly to the edge of the cone, instead of having this interposed flexible rim?
>
> A. To enable the cone to vibrate freely and move freely."

Defendant's witness Jensen said (Tr., 68):

> "The purpose of the soft kid leather is to hold the cone in position, and also to prevent the sound from the front part getting over to the back of the cone."

Defendant's expert Tenny said (Tr., 53):

> "When sound vibrations reach that flexible kid membrane, the softness and yielding qualities of it cause it to absorb a great proportion of that sound, and cause it to absorb and prevent the bulk of that rattling."

The Court of Appeals in its opinion in the instant case said (Tr., 118):

> "It is claimed that the Hopkins form of tympanum, a cone with an annulus at its base, fixed in place at its outer edge obviates this difficulty [blasting], and the evidence shows that it does so to some extent; and that the appellee's loudspeaker by its method of securing the edge of the cone to the fixed frame by limp leather produces the same result and therefore infringes this feature of the patent."

ant has literally copied from the patentee the active conical portion of its loudspeakers. The rim of defendant's structure is narrower than the Hopkins rim, thereby diminishing the over-all diameter of the tympanum to slightly less than nine inches but the narrower rim is made of more flexible material so that the desirable flexibility is retained.

It is plaintiff's position, therefore, that this change in form is a mere colorable departure from the disclosure of the patent, and does not avoid infringement.* We think no other conclusion can be reached unless (1) it appears that the patentee departed from the prior art only in his choice of the material of the rim so that the form (material) of the rim is of the essence of his invention, or (2) the language of the specification and the representations made in argument before the Patent Office are to be taken to exclude this change in the material of the rim.

The Relation of the Hopkins Invention to the Prior Art.

In administering the patent law, the Court first looks into the art to find what the real merit of the alleged invention or discovery is (*Eibel Co.* vs. *Paper Co.*, 261 U. S., 45, 63). An examination of the art convinces us, as it convinced the Court of Appeals for the Third Circuit**, that the real merit of Hopkins' invention lay in

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*_Winans_ vs. _Denmead_, 15 How., 330, at 338-339; _Machine Co._ vs. _Murphy_, 97 U. S., 120 at 125; _Temco, etc., Co._ vs. _Apco, etc., Co._, 275 U. S., 319; and _Sanitary, etc., Co._ vs. _Winters_, 280 U. S., 30 at page 42.

**See the finding of the Court of Appeals quoted *ante* page 4 and its quotation of Hopkins' testimony (pamphlet, p. 57):

> "Now, we mounted that in a support which would permit it to do all of its vibrating in producing the sound and at the same time keep it in the position that it was intended to be and prevent the flimsier portions of the cone near the edges from breaking up or fluttering when we applied a reasonable amount of energy to it."

the production of a thoroughly practical loudspeaker by combining a conical-shaped paper device of proper size, acting in free air, with a flexible rim coupling the cone to a rigid frame.

1. The only sounding-board of the cone type in the prior art is the disclosure in an article by **Starling & Cole*** in "Talking Machine News" of July, 1907 (Tr., 470).**

It is the nearest thing to Hopkins that the prior art affords. It went beyond the heavy flat sounding-boards on the scientifically correct principle of a light stiff conical sounding-board made of paper, but it lacked the other two elements of Hopkins' combination, the rigid frame, and interposed flexible rim. **So far as our present inquiry is concerned, it emphasizes the fact that Hopkins' invention lay in the combination of these three elements, not in the choice of any particular material for the rim.** It has been the backbone of the attack on the validity of Hopkins' patent since the article was first brought to light in the *Western Electric* case.***

The published article is quite clearly expressed and easily understood, as is the structure of the Hopkins patent itself and most of the other prior art disclosures. We do not desire to burden the Court with our own description of things that are already plain. We shall,

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*In this discusssion we print in black face type the names of the authors of those publications and patents specifically mentioned in the opinion of the Circuit Court of Appeals for the Ninth Circuit.

The **Rogers patent 599,867 (Tr., 319) is not a sound emitter, but the sound pick-up device for a telephone transmitter. The opinion of the lower Court in the instant case suggests (Tr., 124) that it might be reversed to act as a sound emitter. The point need not be argued because, if that were done, the resulting loudspeaker would have all the defects and limitations of the **Starling & Cole** paper cone loudspeaker.

****Lektophone Corporation* vs. *Western Electric Co.*, 20 Fed. (2d), 150 Pamphlet, pages 25, et seq.

however, include in this brief quotations from decisions of the Courts that have affirmed the validity of the Hopkins patent so that this Court may conveniently read, if it desires to do so, what the other courts have said about these several prior art devices and their relation to the Hopkins patent. These quotations may be taken as elaborations of our briefer statement of plaintiff's position with respect to the several devices.

In the *Western Electric case*, Thacher, D. J., said (Pamphlet, p. 28):

> "The Starling & Cole publication of 1907 disclosed a vibrating cone employed as a sounding board without sound-box or horn. This extraordinary simple home-made device, constructed of a cardboard mailing tube and a paper cone, was shown to have a purity of tone surprisingly good in the low frequencies which are difficult to reproduce in a sound-box and horn combination. Volume was lacking, and when to increase its volume this device was driven with increased power unwelcome buzzing and rattling sounds were heard, apparently caused by the shaking of the unsupported edges of the extremely light paper cone.
>
> * * * * * *
>
> Starling and Cole disclose the vibrating cone used as a sounding board in free air, but in this device the cone is supported at its apex and its edges are entirely unsupported."

In the *Brandes case*, the Court of Appeals for the Third Circuit said (Pamphlet, p. 57):

> "Of course, Hopkins is charged with notice of the earlier publication by Starling and Cole, which was published in London in 1907 in the talking machine

art. This showed a conical-shaped sounding board, but of such smaller size that it was considered a mere plaything and left no impress on the art. But even if its size had been increased, which in point of fact it was not, its edges would have fluttered or been subject to 'weaving' which would have destroyed its efficiency when low notes were attempted to be given off."

In the *Colonial case*,* Galston, D. J., said (Pamphlet, pp. 121-122):

"Starling and Cole certainly did not disclose the Hopkins' acoustic device. They taught at most:

1. The use of a conical paper diaphragm mounted upon a cardboard tube.

2. The diaphragm had neither annular rim nor fixed support."

Even in the instant case, the Court of Appeals of the Ninth Circuit agreed as to this **Starling & Cole** disclosure, saying (Pamphlet, pp. 90-91):

"It seems that when a cone of thin paper with a free base, such as Starling and Cole invented or proposed, is violently vibrated to reproduce sounds, on certain pitches, that is, with a certain number of vibrations, the free edge of the cone ceases to vibrate bodily with the balance of the cone. Its vibrating edge divides itself into nodes and loops—the nodes are the stationary points, and the loops the portion where the edge vibrates between these stationary points. This causes the cone to produce sounds of its own on certain pitches as well as to reproduce

*Lektophone Corp. vs. Colonial Radio Corp., E. D., N. Y., July 10, 1930, unreported (Pamphlet, p. 112).

sound, and when used as a radio loud speaker causes sharp and unpleasant sounds known as 'blasting' to intermingle unpleasantly with the music, or voice, or sound being reproduced."

The **Starling & Cole** article has been before the Courts of France, England and Germany and has been found by each of them not to disclose or suggest the Hopkins invention.*

2. The large number of other patents relied upon by defendant may be classified as follows:

(a) Sounding-boards of the flat type including the French patent to Ader, 127,180 of 1878 (Tr., 465); British patent to Lodge, 9,712 of 1898 (Tr., 314); and U. S. patents to Shanks, 822,024 (Tr., 330), **Lumiere,** 986,477 (Tr., 352) and **Lumiere,** 1,036,529 (Tr., 363).

(b) Sound-box and horn combinations of the old phonograph art including U. S. patents to Kraemer, 890,142 (Tr., 341), Edison, 963,362 (Tr., 345), English, 1,064,062 (Tr., 378), Brown, 1,096,676 (Tr., 387), Johnson, 1,180,461 (Tr., 393), Elfering, 1,182,078 (Tr., 403), and English 1,192,289 (Tr., 406); and British patents to Stroh, 9,418 of 1899 (Tr., 423), Stroh, 3,393 of 1901 (Tr., 428), Brown, 29,833 of 1910 (Tr., 452) and **Brown,** 1,157 of 1911 (Tr., 459).

(c) A miscellaneous group including the mechanical telephone, U. S. patent to **Maxwell** No. 216,051 (Tr., 308), the **Dann & Lapp** electrical telephone transmitter U. S.

*See the decree of the Court of Appeals at Paris in the Chanoit case (Pamphlet, p. 167); the opinion of Mr. Justice Tomlin in the High Court of Justice, Chancery Division in London (Pamphlet, p. 205); and the decision of the 16th Civil Court of the Provincial Court 1, of Berlin (Pamphlet, p. 252).

patent 338,660 (Tr., 470), and the electrical telephone transmitter U. S. patent to **Rogers**, 599,867 (Tr., 319) referred to in the footnote (*ante*, p. 22).

The Flat Sounding Board Patents.

None of the flat sounding board patents is of sufficient importance to warrant particular notice except **Lumiere** (Tr., 352 and 363). This is a flat sounding board made of paper provided with plaits which gradually diminish in depth from the center of the diaphragm to the clamping rings. The provision of the plaits, however, does not take the **Lumiere** diaphragm out of the flat sounding board class. It is the same as any flat diaphragm except that it is stiffened in such a manner that the stiffness gradually diminishes from the center toward the clamping rings. There is no cone and no bodily sound-producing movement of a large light surface. The movement is a simple bending, of a one-piece structure, progressively decreasing in amplitude from the center toward the periphery.

These **Lumiere** patents have been before each of the Courts that have considered the Hopkins invention. Much stress was laid on them in the opinion of the Court of Appeals for the Ninth Circuit in the instant case (pamphlet, pp. 94-96).

In the *Sylo case*,* which was the first case tried, Campbell, D. J., said (Pamphlet, p. 9):

> "* * * * nor are the claims limited by the prior art as shown in patents No. 562,753 to Amet, No. 822,024 to Shanks, and No. 986,477 to Lumiere, because while these patents all showed attempts to produce self-sustaining sound waves on unconfined

**Lektophone Corp.* vs. *Sylo, etc., Co.*, 11 Fed. (2d), 421 (Pamphlet, p. 1).

air, without the interposition of a sound box or amplifying horn, none of them suggested the idea of accomplishing that purpose by means of a cone of the character described, and actuated in the manner described and claimed in the patent in suit."

In the *Western Electric case,* Thacher, D. J., said (Pamphlet, p. 28):

"Lumiere's diaphragm of plaited paper (U. S. Patent No. 986,477) is most strongly urged as anticipation, as it was before Judge Campbell. Claim is here made that the plaited construction of Lumiere embodies the conical construction of Hopkins with improvements, but I am unable to find in this device equivalents to Hopkins either in structure or in function."

In the *Brandes case,* Judge Bodine in the District Court* held that the **Lumiere** patents completely anticipate Hopkins' invention (Pamphlet, p. 49). This led to a full discussion of these patents by the Court of Appeals for the Third Circuit in the opinion reversing Judge Bodine. The Court of Appeals said (Pamphlet, pp. 58-59):

"Such being Hopkins' disclosure, we next turn to the basic question on which the Court below decided the case, namely, whether Hopkins' disclosure was anticipated by Lumiere in his patents Nos. 986,477 and 1,036,529 of 1912. It is a significant fact that although Lumiere's device was adapted by such a strong company as the Victor, it was never passed into approving public use, and that company itself is using a cone which the General Electric Company makes as licensee under Hopkins' patent. But apart

*16 Fed. (2d), 934 (Pamphlet, p. 46).

from Lumiere's patents having attained no position in the practical art, it is quite clear that he had no conception of that which constituted the gist of Hopkins' invention. Indeed, it seems to us that on final analysis Lumiere had in reality merely a flat sounding board. It is true he used paper and has a construction which may be likened in some sense to a cone, but it seems to us the real plane of Lumiere is the central zone of his paper, for while there is an edge around the apex made by the foldings or corrugations of his paper, and it can therefore be said that he has an outer edge of a dished or quasi-conical shape, it is to be observed that there is a corresponding corrugation structure on the other side of his central or medium zone, and that the two exterior edges of his corrugations, front and back, are not really two individual side cones but are unitary in reality and one structure and that the real plane is the median flat horizontal one midway between the exterior side corrugations. Moreover, making corrugations of this sort changes a fairly flexible plane into a relatively stiff, unyielding structure. Indeed, it would seem that his corrugations were for structural or stiffening purposes rather than for sound purposes. Moreover, the outer edge of Lumiere's paper corrugated structure is flattened and is clamped—and we venture to think as a continuation of his flat median surface—to the rigid structure which holds the cone in place. Lumiere, therefore, not having the flexible rim between his cone proper and his rigid support, his sounding board moves as a unitary structure from the edge of the restraining frame to the central part, while in Hopkins' the cone moves as a whole, unrestrained and unlimited by the rigid frame. Tested by the standard of means and the product, the art never would have had a

practical sounding-board had it stopped with Lumiere. It was Hopkins who gave a successful combination which produced low, clear tones on a conical sounding-board in free air."

In the *Colonial case,* Galston, D. J., said (Pamphlet, p. 122):

"Lumiere discloses a flat diaphragm. I agree with both Judges Campbell and Thacher that these patents fail to disclose the conical construction of Hopkins, either in structure or in function."

These **Lumiere** patents were considered and found not to disclose or suggest the Hopkins invention by the Courts of France, England and Germany.*

On the particular issue of infringement with which we are now concerned, it is clear that the Lumiere diaphragm affords no support for defendant's position that Hopkins' patents ought to be limited to a tympanum made in a single piece of the same material throughout. Lumiere's diaphragm was made of a single piece of paper, but it did not have a conical sounding board coupled to a rigid frame by a flexible rim. There was no bodily movement of a sounding board of large area as in Hopkins, but a simple flexing of a flat sounding board stiffened by radial plaits.

This **Lumiere** diaphragm also negatives the thought that Hopkins' invention lay in the mere increase of the area of a direct-acting sounding board to a diameter more than nine inches. **Lumiere's** diaphragm exceeded that size.

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*See the Judgment of the Civil Tribunal of the Seine in the Radio-Electrique case (Pamphlet, pp. 178-180); the affirmance of that decision by the Court of Appeals of Paris (Pamphlet, p. 189); the decision of the Berlin Court (Pamphlet, p. 252), and the opinion of the High Court of Justice in England in the Brown case (Pamphlet, p. 207).

The Sound Box and Horn Combination Patents.

Each of these patents discloses a phonograph sound box associated with a horn. In each the diaphragm of the sound box has a conical central portion and a flexible rim supported by rigid rings that constitute the enclosing side walls of the sound box. In some of them the flexible rim is a plane peripheral extension of the cone (Kraemer, Tr., opposite pp. 340, 342; Edison, Tr., 345; Johnson, Tr., opposite pp. 392, 394; Stroh, Tr., 428); in others it is made of more flexible material, such as "soft rubber" or "other materials than rubber, such as leather, paper, thin collodion, etc." (Edison, Tr., 348), "rubber or other suitable solid resilient or yielding material" (English, Tr., 380); "tissue paper or other suitable material that will not exert appreciable restraint upon the diaphragm" (Brown, Tr., 391); "gold beater's skin" (Elfering, Tr., 404); "cork or a composition of cork or * * * other suberous or suitable yielding material" (English, Tr., 409); or a "thin ring of flexible material * * * of tissue paper, silk, or other suitable material" (Brown, British patent 29,833, Tr., 455 and 457) or "a ring of resilient material of extreme thinness" such as "glazed tissue paper one-three thousandths of an inch thick or thin collodion film" (**Brown** British patent 1,157 of 1911, Tr., 461 and 463).

Hopkins' differentiation from these patents did not lie in any choice of particular form or material for the flexible rim. Some of them show plane peripheral extensions of the cone like Hopkins and others show rims made of more flexible material like defendant's.

These sound-box and horn combination patents have likewise been before each of the courts. In the *Sylo case*, Campbell, D. J., said of them (Pamphlet, [illegible] p. [illegible]3):

> "The invention of the patents in suit seems to me to be something more than a mere improvement

upon the sound-box horn combination of the prior art, because the patentee of the patents in suit has discarded the sound-box horn principle and proceeded successfully along the line of sounding boards.

He discovered that a large stiff, light cone of vibratile material, if properly supported, would vibrate to all the essential frequencies of the audible spectrum, and would faithfully reproduce on unconfined air the original sounds when a mechanical vibration representing those original sounds was imparted to the apex of the cone."

In the *Western-Electric case*, Thacher, D. J., discussed them, alone and in connection with **Lumiere**, as follows (Pamphlet, pp. [redacted] 28-30):

"In various prior art devices of the sound-box horn type, and in telephone receivers, small rigid conical diaphragms, usually of metal construction with flexible rims to permit vibrations of the cone as a whole and without flexing, are found, as illustrated in Stroh, British Patent 3,393; Gaumont, French Patent 331,226; Edison, U. S. Patent 963,362; Brown, British Patent 29,833, and English, U. S. Patent 1,064,062. Of these patents, only two were considered by Judge Campbell—the British patent to Stroh, which is mentioned in his opinion, and the United States patent to English, which is referred to by the Examiner. Each is typical of the others, all of which differ from Hopkins in that they have to do with telephone receivers or sound boxes. Brown confined his claims to telephone receivers but in his specifications said: 'Where it is desired to make the sounds travel out into a room a receiver of large size is preferable.' This is purely casual and obscure, but it is as close as anyone came to Hopkins. What Hopkins really did was to take

the small conical diaphragms used in sound boxes, throw away the horn and sound-box, and by experiment determine the dimensions required in such a diaphragm for radiating sound waves in free air. This seems a simple thing to have done, in view of the prior development of similar diaphragms in sound-box construction. But the prior art discloses that he was not only the first to construct a sounding-board upon these principles but that his construction was a valuable improvement. It is insisted that what Hopkins did was not invention, *Atlantic Works* vs. *Brady,* 107 U. S., 192, and similar cases, being cited. In brief, the argument is that Hopkins took the large diaphragm of Lumiere and substituted for its plaited construction the conical construction of Stroh, to give it an equivalent stiffness, and the annular rim hinge of Stroh to give it bodily motion. If it is meant that Hopkins is merely a substitution of equivalents for Lumiere, and, therefore, lacking in invention under the rule in *Smith* vs. *Nichols,* 21 Wall., 112, 119, the argument fails because Hopkins' rigid cone and flexible annular rim, although found in Stroh, has no equivalent in Lumiere. On the other hand, if Hopkins is not a mere substitution of equivalents for Lumiere he must be conceded a combination of elements novel in a sounding-board, although old in a sound-box. There is not to be found in the prior art a sounding-board such as Hopkins designed and had patented as his invention, and it is not enough to defeat his patent to say that the elements of his claims are already found in the prior art in isolation or in other combination.

Bates vs. *Coe,* 98 U. S., 31;
Imhauser vs. *Buerk,* 101 U. S., 647, 660;
Barbour vs. *Otis,* 240 Fed., 723, 726.

> "His was a combination and arrangement of old elements capable of better results than the old devices (*Loom Co.* vs. *Higgins*, 105 U. S., 580, 591). Of course, the application of these rules must not be carried too far, and if the change from sound-box to sounding board construction were so obvious as to occur to an ordinary skilled mechanic familiar with the prior art undoubtedly the rule in *Atlantic Works* vs. *Brady, supra,* would govern, as is clearly stated in *Loom Co.* vs. *Higgins, supra.* But I am satisfied that the tympanum of novel construction which is covered by the claims of Patent No. 1,271,529 which are in suit involves invention, and was not merely the exercise of mechanical skill."

In the *Colonial case,* Galston, D. J., discussed them in some detail and found that they did not anticipate (Pamphlet, pp. 122-124). They were considered, and rejected as anticipations, by the French, German and English Courts.*

The Maxwell Mechanical Telephone Patent.

The patent to **Maxwell** 216,051 (Tr., 308) relates to the ancient art of mechanical telephones now long forgotten except by those of us who played with them as boys. It illustrates and describes what is said to be an improvement over an earlier arrangement of the same inventor, which earlier arrangement is illustrated in Fig. 1 of the patent. The improvement consisted in the re-

*See the judgment of the Civil Tribunal of the Seine in the *Chanoit case* (Pamphlet, p. 152) the affirming decree of the Court of Appeals of Paris (Pamphlet, p. 167), the judgment of the Civil Tribunal of the Seine in the *Radio-Electrique case* (Pamphlet, pp. 180-181) and the decree of the Court of Appeals of Paris affirming that judgment (Pamphlet, p. 189), the decision of the British Court particularly discussing the patents to Brown and to Stroh (Pamphlet, pp. 206 and 207-8), and the decision of the German Court (Pamphlet, pp. 243-245).

arrangement of the stretched sheep-skin membranes so as to **eliminate the idea of a sounding-board** and substitute a resonant chamber.

That the earlier and less improved arrangement illustrated in Fig. 1, upon which defendant now relies, did not give good results is shown by the patentee's statement (pat., p. 1, bottom of first column, Tr., 309):

> "Now my invention herein claimed relates to the construction of a vibratory apparatus of quite different form and of a much better result from the one hereinbefore described."

The disclosure of the construction of Fig. 1 is incomplete (first column of patent, Tr., 308-309), but it may be assumed from the drawing that the vibrators of the earlier construction were like the vibrators of the improved construction. As to these, the patentee says (pat., p. 2, first column, Tr. 310):

> "The vibrators are stretched and held taut by means of the button *e* on the wire *T;* and but for the button *i* on the wire outside of the box the vibrators would collapse"

Clearly such a vibrator is not the light stiff paper cone of Hopkins, or its equivalent.

Furthermore, there is no rigid frame and interposed flexible rim in **Maxwell.** The vibrators are fastened directly to the edge of a circular opening in a wooden sounding-board. The patentee says (Pat., p. 1, first column, Tr., 309):

> "* * * the vibrators are made of sheepskin or like material, and should be fastened upon the sounding-boards over the openings therein while in a wet and plastic condition, and then have their central

> portion drawn out and stretched until they assume a funnel-like form, and then be allowed to dry and retain that form."

Where Hopkins shows a conical sounding-board supported from a rigid frame by a flexible rim to permit the bodily sound-producing motion of the conical sounding-board, **Maxwell** discloses a wooden sounding-board having a hole in its center to the edge of which is fastened a conical sheepskin vibrator having stiffness only when it is held taut by a stretched wire and necessarily without any interposed flexible rim, since it is the purpose of the vibrator to impart the vibrations to the sounding-board, and an interposed flexible rim would prevent that.

Plaintiff's position as to the structural relation of this **Maxwell** patent to the Hopkins invention is summed up in the words of Galston, D. J., in the *Colonial case* (Pamphlet, p. 122):

> "Maxwell in No. 216,051 shows a stretched sheepskin membrane in a mechanical telephone * * *. The sounding board of Maxwell is certainly not the flexible rim of Hopkins."

Contrasting this patent with Hopkins shows again how Hopkins invention lay in the combination of a large light stiff conical sounding-board, ~~to~~ a rigid frame and an interposed flexible rim. **Since the Maxwell patent shows no rim at all, it cannot have any effect to limit Hopkins patent to the use of a particular material in the rim.**

This patent was much relied upon by the defendant in the *Sylo case* and is fully discussed by Campbell, D. J. (Pamphlet, pp. 8, 9). It was not again pressed upon the attention of any of the American Courts passing on the validity of the Hopkins patent until the present case.

The Civil Tribunal of the Seine in the *Radio Electrique case* adopted Judge Galston's views about it (Pamphlet, p. 180); and see affirmance of that judgment by the Court of Appeals of Paris (Pamphlet, p. 189).

The Dann & Lapp Telephone Transmitter Patent.

The patent to **Dann & Lapp** 338,660 (Tr., 470) shows a telephone transmitter of even smaller size than the sound-box horn diaphragms. It has a conical vibrator at the base of the telephone mouthpiece. The diameter of the base of the cone is said (Tr., 471) to "equal and even slighfly exceed that of the contiguous inner end of the mouthpiece B, of which it forms practically a conical extension." The inner end of a telephone mouthpiece is about one-half inch in diameter. The Court of Appeals assumed that the structure might also be applied to a telephone receiver (Tr., 123). If so, the **Dann & Lapp** structure might be classed with the sound-box horn combination patents hereinbefore discussed. How far it is from the Hopkins device is indicated by the provision of dampers on the flat portion of the diaphragm to "choke out the metallic clang" (Pat., p. 2, lines 80-84, Tr., 474).

The rejection of this patent as of anticipating or limiting effect by Galston, D. J. in the *Colonial case* (Pamphlet, pp. 122-123) correctly expresses plaintiff's position about it. The disclosure in no wise resembles the Hopkins invention, and the patent has not been discussed in any other case.

The Nature of Hopkins' Inventive Act Looked at From the Point of View of the Prior Art.

It seems to us that the real character of Mr. Hopkins' invention and how it is different from what went before

it, is very clear. The practical utility of his simple three-element device is too well established to require argument here. Mr. Hopkins tells in an interesting and illuminating way (Tr., 73-74), the history of the invention. He says that after long experimenting in the Edison laboratories on sound-box and horn combinations, he despaired of overcoming the inherent deficiencies of that combination and turned to sounding-boards. After trying out many known types of sounding boards and finding them too heavy, he turned to paper structures and finally tried the conical shape,—

> "with the idea that it was a light and very stiff structure, it almost immeditely showed a big advance over any of the other structures that we tried" (Tr., 73).

The paper cone was in principle the same as the direct acting sounding-board of **Starling & Cole**, which those scientists found to give remarkably good sound reproduction, although of very small volume, so small that*

> "It would serve excellently to try over records without disturbing others in the house when they need to be repeatedly played as in the study of folk-songs and language lessons by aid of the phonograph."

But the use of that device was (Hopkins, Tr., 74)

> "limited by the waving or rattling that invariably accompanied a simple cone, * * *. When the cone vibrated, the outer edge of the cone would break up into nodes or loops, the nodes being comparatively still portions which moved with the movement of the cone, but the loops the portions in which one wave was going out while another was going in. In other

*Last sentence of article, bound opposite Tr., page 470—three pages.

words, it was a bell motion of the paper of the cones."

So Hopkins added to this sounding-board a flexible rim anchored at its peripheral edge in a rigid frame. This flexible rim permitted the sound-creating movements of the cone but inhibited the troublesome nodes and loops that gave rise to the rattling or blasting (Tr., 74).

As we look back over this research which started with the sound-box and horn combination, we see that Hopkins dispaired of getting the desired results with that combination, turned to flat sound-boards, and ended with the thing disclosed in the patent. His accomplishment may be characterized in either one of two ways:

(a) He took the small conical diaphragms used in sound boxes, threw away the horn and sound box and by experiment determined the dimensions required in such a diaphragm for radiating sound waves in free air;*

(b) He took the interesting toy of **Starling & Cole** with its paper cone wholly unsupported at its edge and effectively added to it a supporting structure that would make the thing practical, permitting it to vibrate in its sound-producing way and yet restraining it from such vibrations as would produce blasting. Specifically, this was effected by adding the rigid supporting rings and interposing between the rings and the cone a flexible rim.**

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*We adopt here the language of Thacher, D. J., in the *Western Electric case* (*ante*, pp. 31-32).

**In this analysis the Lumiere patent does not come into question at all. Either Lumiere is a direct anticipation of Hopkins or else it is evident that it required invention to do what Hopkins did. In any case it cannot be said that Hopkins followed Lumiere. It was precisely because he did not follow Lumiere that he succeeded.

Looked at from the first point of view, the Hopkins invention is, as Campbell, D. J., said, in the *Sylo case,* (*ante,* pp. 30-31) "something more than a mere improvement upon the sound-box horn combination of the prior art, because the patentee of the patents in suit has discarded the sound-box horn principle and proceeded successfully along the line of sounding-boards."

Looked at from the second point of view the Hopkins invention may be said to be a last step invention, in the sense that it added to one of the many prior art unsatisfactory direct-acting devices just those elements necessary to make it a practical operative loudspeaker.

From neither point of view is it any wise essential that the interposed flexible rim should be of the same material as the central conical portion of the tympanum.

On the contrary the disclosures of the cone diaphragm structures of the sound-box horn combination patents show that no patentable novelty could be predicated upon the material of the rim.

It was not in the material of the rim, but in throwing away the sound-box and horn and enlarging the structure to produce a direct-acting loudspeaker that Hopkins departed from the prior art of sound-box and horn structures. Having, by this exercise of inventive ingenuity, bridged the gap between the soundbox and horn constructions and the successful direct-acting loudspeaker, it requires no more than engineering skill for someone else to use in Hopkins' combination the rims of various materials that had previously been used in the small diaphragm constructions.*

Crown Cork & Seal Co. vs. *Sterling, etc., Co.,* 217 Fed., 381, at page 385; and *Concrete Appliances Co.* vs. *Meinken,* 262 Fed., 958, at page 961.

Is the Defendant's Structure Excluded from the Monopoly by the Disclosure of the Specification and the Patent Office Proceedings?

We preface discussion of the patent office proceedings by a statement of what we understand to be the law as to estoppel, on the one hand, and as to the interpretation of the patent specification by extraneous reference to things said in argument, on the other hand.

It is plaintiff's position that the rule of estoppel arising from patent office proceedings is limited, by all authority, to the situation where an applicant, during the prosecution of his application, cancels a broad claim and replaces it by a narrower claim. After that he is estopped to assert that the limitations imposed upon the narrower claim are not essential, or to ask that the narrow claim be interpreted to have the scope of the broader canceled claim. Within that limitation the rule of estoppel is well established; although it is a somewhat anomalous rule. Beyond that limit this Court has never extended the doctrine* nor has any Court of Appeals, and the

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*The pertinent cases in this Court are: *Leggett* vs. *Avery*, 101 U. S., 256, 259-260; *Goodyear, etc., Co.* vs. *Davis*, 102 U. S., 222, 224-228; *Mahn* vs. *Harwood*, 112 U. S., 354, 361; *Cartridge* vs. *Cartridge*, 112 U. S., 624; *Sargent* vs. *Hall*, 114 U. S., 63, 86; *Shepard* vs. *Carrigan*, 116 U. S., 593, 597-8; *Sutter* vs. *Robinson*, 119 U. S., 530, 541; *Crawford* vs. *Heysinger*, 123 U. S., 589, 606; *Watson* vs. *Cincinnati Ry. Co.*, 132 U. S., 161, 165; *Roemer vs. Peddie*, 132 U. S., 313, 316-317; *Phoenix, etc., Co.* vs. *Spiegel*, 133 U. S., 360, 367-368; *Dobson* vs. *Lees*, 137 U. S., 258, 265; *Royer* vs. *Coupe*, 146 U. S., 524, 529-532; *Corbin* vs. *Eagle Lock*, 150 U. S., 38, 40; *Knapp* vs. *Morss*, 150 U. S., 221, 224-225 and 229; *Morgan, etc., Co.* vs. *Albany, etc., Co.*, 152 U. S., 425, 429; *Lehigh, etc., Co.* vs. *Kearney*, 158 U. S., 461, 469; *McCarty* vs. *Lehigh, etc., Co.*, 160 U. S., 110, 118-119; *Westinghouse, etc., Co.* vs. *Boyden, etc., Co.*, 170 U. S., 537, 558, etc.; *Hubbell* vs. *U. S.*, 179 U. S., 78, 80; *Kokomo, etc., Co.* vs. *Kitselman*, 189 U. S., 8, 14-19; *Singer Co.* vs. *Cramer*, 192 U. S., 265, 284; *Computing, etc., Co.* vs. *Automatic Scale Co.*, 204 U. S., 609; *Weber, etc., Co.* vs. *Freeman, etc., Co.*, 256 U. S., 668; *I. T. S. Co.* vs. *Essex Co.*, 272 U. S., 429, 436.

majority of the Courts of Appeals (1st, 2d, 3d, 4th, 7th and 9th) have explicitly refused to give any effect of estoppel to statements made by an applicant's attorney during the proceedings in the patent office.*

It was in recognition of this limitation of the rule, and on these authorities, that the Court of Appeals in the instant case found no estoppel (Tr., 129).

Without any aspect of estoppel, and only for the purpose of confirming the Courts' own interpretation of the patent specification, this Court has, on two occasions, referred to things said by the patentee or on his behalf in argument.

That was done in *Goodyear, etc., Co.* vs. *Davis,* 102 U. S., 222, where this Court said (p. 227):

> "We do not mean to be understood as asserting that any correspondence between the applicant for a patent and the Commissioner of Patents can be allowed to enlarge, diminish or vary the language of a patent afterwards issued. Undoubtedly a patent, like any other written instrument, is to be interpreted by its own terms. But when a patent bears on its face a particular construction, inasmuch as the specification and claim are in the words of the patentee, it is reasonable to hold that such a construction may be confirmed by what the patentee said when he was making his application. The understanding of a party to a contract has always been regarded as of some importance in its interpretation."

**American Cone & Wafer Co.* vs. *Denaro,* C. C. A., 1, 297 Fed., 913; *R. Hoe & Co., Inc., et al.,* vs. *Goff Press Co.,* C. C. A., 2, 30 Fed. (2d), 275, and cases cited; *Boyer* vs. *Keller Tool Co.,* C. C. A., 3, 127 Fed., 130, at pages 133, et seq.; *Pangborn Corp.* vs. *W. W. Sly Mfg. Co.,* C. C. A., 4, 284 Fed., 217; *McCormick, et al., Co.* vs. *Medusa, et al.,* C. C. A., 7, 222 Fed., 288; *W. F. Burns Co.* vs. *Automatic, et al.,* C. C. A., 7, 241 Fed., 472; *Fullerton Walnut Growers Ass'n* vs. *Anderson,* C. C. A., 9, 166 Fed., 443; *J. A. Mohr & Son* vs. *Alliance, etc., Co.* (D. C., N. D., Cal.), 14 F. (2d), 793, 798-9, approved and affirmed 14 F. (2d), 799.

In *Westinghouse* vs. *Boyden, etc., Co.*, 170 U. S., 537, this Court (pp. 558-560) again referred to communications made by the applicant during the patent office proceedings in confirmation of the Court's own interpretation of the language of the specification.*

With this understanding of the law, we shall discuss first the changes in claim language under the heading "Estoppel" and then we shall discuss the things said in argument under the heading "Interpretation." We have to look at the parent application (Pltf.'s Ex. 7, Tr., 160) which resulted in patent 1,271,527, as well as at the divisional application (Pltf.'s Ex. 6, Tr., 159) which resulted in the patent in suit.**

Estoppel.

We shall first discuss changes made in the claim language as to the rim; and then discuss changes made in claim language defining the size of the tympanum (cone plus rim).

Changes Made in Claim Language as to the Rim.

The original claims 15, 17, 18, 19 and 20 (A. F. W., pp. 1, et seq.) defined the rim as "**an annular plane** adjacent said support".

During the prosecution of the application several sound-box horn combination patents having small con-

*In that case Justices Shiras, Brewer, Gray and McKenna dissented from the opinion and from the decision of the Court, and Justices Shiras and Brewer joined in a vigorously expressed objection (pp. 581-583) to even that limited recourse to things said in argument.

**The file wrappers are so hard to follow that we have extracted from them and printed separately the file wrapper history so far as it pertains to the subject-matter in issue. See pamphlet "Abbreviated File Wrapper History Including All that Pertains to the Subject-Matter in Issue", referred to hereinafter as A. F. W.

ical diaphragms were brought to applicant's attention by the examiner. In some of these the cone was coupled to the supporting frame by an annular plane peripheral extension of the cone, as in Hopkins. In others the coupling was effected by a rim made of a separate piece of more flexible material. It was evident that as rims of more flexible material had been used in the small sound-box diaphragms so rims of more flexible material could be used in Hopkins' construction.

Applicant thereupon amended his claims, substituting for the words "an **annular plane** adjacent said support" the words "an **annular sustaining rim** adjacent said support" in one of the claims (claim 11, A. F. W., p. 13) and the words "an **annular rim** adjacent said support" in the other claims (claims 12-16, A. F. W., pp. 13-16). When the divisional application was filed this expression "**an annular rim**" was used, as in claims 5, 6 7 and 8 of the patent.

Thus, as to the rim, the patentee deliberately broadened the language of his claims, so that they might not be limited even in terms to a plane peripheral extension of the paper cone.

All thought of estoppel seems to us to be excluded, by that act. It constiutes, indeed, a recognition on the part of the examiner that the form and material of the rim is not an essential characteristic of Hopkins' invention and that the patent monopoly ought not to be limited to a peripheral rim extension of the cone.

Changes Made in Claim Language as to Size.

Some of the original claims (A. F. W., pp. 1, et seq.) defined the size of the structure only by saying that it is "a sound regenerator for directly propagating self-sustaining sound waves in air" (claim 15), or by adding to that the proportional requirement that the base of the conical portion "exceeds in area one-half the effec-

tive area of said tympanum" (claim 16), or "the diameter of the base of said conical portion being substantially eight-tenths of the diameter of said circular aperture in said support" (claim 18).

Others of the original claims specified a tympanum (cone plus rim) "exceeding nine inches in diameter" (claims 17 and 20).

All of these claims were rejected (A. F. W., 3) on the sound-box and horn combination patents, with the remark that "The size of the diaphragm is not a patentable limitation."

The applicant declined to accept that ruling and, by the first amendment (A. F. W., 7-8) added three more claims (39, 40 and 41) defining the tympanum as having "a free area exceeding nine inches in diameter"; and one claim (57) defining the size of the tympanum as

> "a vibratory area of sufficient size to effect, without amplification, the regeneration from the record of sound waves of relatively large volume and carrying power."

The claims were again rejected on the sound-box and horn combination patents taken in connection with Lumiere (A. F. W., 9-10).

The applicant, however, persisted. He added in the next amendment two claims (1 and 2, A. F. W., 10) in which the size of the tympanum was defined as

> "of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves".

At the same time original claims 15 to 20 were rewritten. In some of them the broader definition of size just above quoted was incorporated (claims 11, 12, 14

and 15), and in others (claims 13 and 16) the size of the tympanum was defined as "exceeding nine inches in diameter".

Again the examiner rejected the claims on the same references (A. F. W., 16) and in a further effort to find claim language, not unduly restricted but differentiating his invention from the horn and sound-box combination patents, applicant inserted in the claims the words "without an amplifying horn or chamber" (A. F. W., 17).*

In the next office action, the examiner, withdrawing now from his position that applicant had made no invention, rejected the claims on the ground that they were indefinite as to size. But the applicant insisted upon claims in which the size of the tympanum was defined in both ways, and the examiner yielded.

When subsequently the claims for the acoustic device *per se* were transferred to the divisional application which resulted in patent 1,271,529 here in suit, they included present claims 1, 2, 3, 5 and 7 of the patent in which the size of the tympanum is defined as "exceeding nine inches in diameter", as well as present claim 4 of the patent which defines the tympanum as

> "of sufficient area to impart to the surrounding free air, when vibrated, sound waves substantially corresponding in intensity to the original sound waves."

The divisional application as filed also included a claim numbered 12 (A. F. W., 25) which defined the size of the tympanum as

> "of sufficient area to impart to the surrounding free air, when vibrated, sound waves substantially corresponding in intensity to the original shocks or vibrations".

*These words were subsequently erased as unneccessary (A. F. W., 24).

This claim was replaced by claim 8 of the issued patent which defines the tympanum as

> "of sufficient area to produce self-sustaining sound waves in the surrounding air when vibrated."

In this contest between the patentee and the patent office, there was no cancelling or amendment of broader claims to introduce limitations which plaintiff now seeks to delete. There was an insistence upon broad claim language with which plaintiff is now satisfied. **The conduct of the applicant was that of a person who is determined that the monopoly shall not be limited by literalism to a tympanum (cone plus rim) having an over-all diameter of nine inches. So far from manifesting an intention to disclaim any functionally equivalent structure in which the over-all diameter of the tympanum might be less than nine inches, his conduct plainly manifests a contrary intention.**

And the examiner's acquiescence, after full discussion of the most important prior art, strengthens the *prima facie* presumption in favor of the patent.

Interpretation.

We do not think that this Court will find any need to resort to the file wrapper history for confirmation of its interpretation of what is said within the four corners of the patent specification.

We think the meaning is very plain to anyone who reads the specification, as this Court will read it, intent to discover the principle of which the structure particularly disclosed is merely the reflex and embodiment—the law of cooperative action of the three-element combination.

Anyone reading the specification with that purpose would certainly have in mind the question **why** the large,

light, stiff, paper cone is used and **why** a plane peripheral rim is used to couple the cone to the rigid frame. It seems to us that the answer to those questions can be deduced by a reasonably intelligent person from the stated purpose alone, which is said to be (Pat., p. 1, lines 94, et seq.):

> "the provision of a tympanum of novel construction, which is capable of responding to the high frequency vibrations employed in the reproduction of sounds, and of imparting these vibrations to a large body of air."

The largeness and stiffness of the paper cone are necessary to impart the vibrations to a large body of air, and the lightness is necessary to enable it to respond to the high frequency vibrations employed in the reproduction of sounds. If the supporting and protective frame were clamped directly onto the peripheral edge of the cone, its ability to respond to the high frequency vibrations would be destroyed. The rim that couples the cone to the frame is therefore made flat so that it will yield, and not inhibit the sound-producing movements of the cone.

When the patentee comes to the specific description of preferred embodiment that the law requires him to make, and which he illustrates in the single figure of the drawing, he says, referring to the drawing by reference letters, that the tympanum L, made up of the conical portion *l'* plus the plane peripheral rim *l*, should have an over-all diameter not less than nine inches and that the "base of the conical portion should exceed in area one-half of the area of the entire tympanum."*

*Even these sizes are said to be "approximate" and the proportions are said to be subject to some variation even when the designer limits himself to the construction as shown in the drawing (Pat., p. 2, lines 96, et seq.).

Is it not clear that the conical shape gives stiffness over a large area to impress the vibrations on a large body of air; in accordance with the stated purpose? Is it not equally clear that the conical portion is coupled to the rigid frame by a plane peripheral rim in order that its capacity to respond to the high frequency vibrations may be preserved; that the rim portion is flattened to give it yielding flexibility, and that if the patentee had not desired the quality of yielding flexibility in the rim as distinguished from the quality of unyielding stiffness in the conical portion, he would have extended the conical shape to the rigid support, omitting the flat rim?

So also it is pertinent to ask why the patentee mentions the necessary size of the conical portion, in addition to the over-all diameter of the tympanum (cone plus rim). Is it not clear that he does that because the conical portion (elsewhere referred to as the "active conical portion") is the effective sound producer of which the rim is the yielding support?

Contending that the scope of the monopoly should be limited to cone and rim made from a single piece of crisp, strong material throughout, defendant particularly stresses the following sentence of the specification (p. 2, lines 103, et seq.):

> "It is of vital importance that the tympanum be made of crisp, strong material, having considerable rigidity within itself, * * *."

It seems to us that any intelligent reader would understand that this rigidity is important only in the active conical portion of the tympanum, so that it may be capable of imparting the high frequency vibrations to a large body of air. That the rigidity should extend into the rim is inconsistent with the stated purpose of the rim, as it is inconsistent with the disclosed plane peri-

pheral form of the rim. Indeed, we think that the statement just quoted, when read in the light of the immediately following phrase, fairly indicates, even if consideration should be given only to mere matters of phraseology, that the crisp, strong material having considerable rigidity within itself is important only in the conical portion of the tympanum. Although the patentee says, in the part of the sentence already quoted, that the "tympanum" should be of crisp, strong material, yet in the following clauses, he says "and it is also of vital importance that the tympanum *as a whole* be extremely light and have as little inertia as possible without a weakening effect". The words "tympanum as a whole" in the last phrase of that sentence would seem to embrace something more than the word "tympanum" as used in the first phrase of the sentence. It is, of course, important that the rim as well as the cone should be extremely light and have as little inertia as possible without a weakening effect.

In the next two sentences, the word "tympanum" is quite definitely applied to the conical portion alone. It is said that "the tympanum is shown of conical form" and that the "conical shape is given the tympanum" so that the vibrations impressed upon its apex will move the whole cone bodily and the intended object, a simultaneous movement of the whole conical portion of the tympanum, will be attained. Is it not plain that if the rim were stiff and rigid, such bodily movement of the conical portion could not be attained; and that it was for this reason that the patentee made the rim portion flat?

If there could be any doubt on that subject, would the doubt not be removed by the next two sentences (Pat., p. 2, line 124, to p. 3, line 5) where the patentee, having reference to the form of the plane peripheral rim, says that it is possible to form radial or concentric corrugations in it and that if this is done some variations may

be made from the proportions given, but such variations will not be great? Such corrugations in the rim affect only its yielding flexibility. The significance of these statements seems clearly to be that the patentee contemplated a variation of inherent flexibility of the rim structure, and said that such variation in inherent flexibility of the rim would permit some corresponding variation in the width of the rim.

Unless we are mistaken in thinking that this is the reasonable interpretation of the patent specification, it is plain that defendant has quite literally followed the disclosed principle of the invention, not only in the shape, material and size of its cone, but also in its rim structure.

It is not difficult to look through the change of form by which defendant has slightly reduced the over-all diameter of the tympanum (cone plus rim), while retaining the principle and mode of operation of the whole combination and the full size of the active conical portion. That has been achieved by reducing the width of the flexible rim, while substituting more flexible material to retain the desired flexibility in accordance with the principle of Hopkins' invention.

But whether this Court's own interpretation of the disclosure in the specification agrees with ours or not, we think that interpretation would not be affected by the patent office proceedings.

So far as the form and material of the rim is concerned, the whole substance of the patent office proceedings is embraced within applicant's deliberate amendment of the claims to change the words "an annular plane adjacent said support" to the words "an annular rim", as they appear in the claims of the patent (*ante*, pp. 42-43).

As to the size of the tympanum as a whole, there was considerable discussion in the patent office. In that dis-

cussion the applicant insisted that a direct-acting loud-speaker of the construction and large area disclosed in the specification is a patentable advance over the use of small cone diaphragms in the sound-box and horn combination, on the one hand, and over the disclosure of the large flat diaphragm of Lumiere's patents on the other hand.

The examiner more than once rejected the claims on reference to the horn and sound-box combination patents, taken in connection with Lumiere; but the applicant insisted and finally prevailed, thereby strengthening the *prima facie* validity of the patent which has since been repeatedly, and always unsuccessfully, attacked on the same ground.

Throughout the patent office proceedings, the applicant endeavored to arrive at a definition of size, other than the specific limitation to an over-all diameter not less than nine inches, and in this he also prevailed, as we have already seen (*ante*, pp. 43-46).

Things Said In Argument with Respect to Size.

In the original specification and claims the expression "self-sustaining sound waves in air" was used. It persisted through the patent office history and appears in claim 8 of the issued patent in the phrase "being of sufficient area to produce self-sustaining sound waves in the surrounding air."

In the first office action the examiner rejected the claims on the sound box horn combination patents, saying (A. F. W., 3):

> "What does applicant mean by self-sustaining sound waves" and "The size of the diaphragm is not a patentable limitation".

In reply applicant paraphrased his description of the mode of operation of the sound box horn combination that appears in the first part of the patent specification, and added (A. F. W., 5):

> "In order to obtain faithful reproduction of the original sound waves, that is, to really regenerate the original sounds, applicant has provided a sound regenerating machine which dispenses with the employment of a horn or trumpet for transforming high tension disturbances into waves of lower tension, and in which the vibration of the stylus by the record are mechanically directly transmitted to a diaphragm which is free to vibrate in unconfined air, which has sufficient area to set in motion a large volume of air, which is sufficiently light and rigid to enable it to move in synchronism with the stylus, and the distance of vibration of which is sufficiently short to permit of a relatively slow movement appropriate for the sound conductivity of air, whereby the regenerated sounds will be self-sustaining and will be accurate reproductions of the original sounds.
>
> Applicant has thus produced a machine in which the sounds are regenerated directly from the record and in open and unconfined air, without the intervention of a sound box and its confined body of air, and without the intervention of any vibration transforming device, such as a horn or trumpet.
>
> So far as applicant is aware the machine of this invention is the first which has ever been constructed which will accurately regenerate the original sounds without distortion, without squeaking, without accentuation of notes of certain pitch, without change in intonation and without any appreciable loss of energy, and which in fact will produce faithful reproductions of the original sounds. * * *"

He then argued that this different structure with its different mode of operation and different result was sufficiently defined in the rejected claims, saying (A. F. W., 6-7):

> "Each of the claims 15-20, inclusive, is drawn to the combination of elements therein set forth as combined in a sound regenerator for *directly propagating self-sustaining sound waves in air.* Each of the devices of the references is an ordinary reproducer having a small diaphragm operating in a sound box having a small volume of confined air, and requiring, in order to set up self-sustaining waves, the intervention of a transforming device, such as a horn or trumpet, to change the high tension vibrations into lower tension waves of greater amplitude." (Emphasis in original.)
>
> * * * * * *
>
> "For these reasons the references cited against claims 15-20, inclusive, do not meet the claims. With reference to claim 17 which specifies a tympanum exceeding 9 inches in diameter, it is submitted that the size of the tympanum is what enables it to effect direct regeneration of the sound. When a horn is employed for transforming high tension disturbances, the size of the tympanum is immaterial. Applicant has practically demonstrated that, to effect direct regeneration from the record of the sounds, a light vibratile tympanum of *substantially* 9 inches in diameter or greater must be employed in order to obtain faithful reproductions." (Emphasis ours.)
>
> * * * * * *

> "The dimensions of the diaphragm and of the conical portion thereof, as set forth in claims 15 to 20 inclusive, are essential elements in a direct sound regenerator, but they are not essential in sound boxes which employ horns or trumpets as do all of the references which have been cited against these claims. This has been demonstrated by the applicant by actual trial."

Defendant laid great stress, in the Court below, upon this last statement, interpreting it to mean that applicant here said that the nine inch limitation is essential. But that limitation appeared only in claims 17 and 20, not in claims 15, 16, 18 and 19 where the size was more broadly defined. Applicant was here saying that the large size **defined in the specification** is essential. That size is **substantially** nine inches in over-all diameter of the tympanum. The patentee, insisting that he should not be boxed in by literalism, demanded and secured claims having phraseology more inclusive than the literal meaning of the words "a free area exceeding nine inches in diameter."

In the second office action the examiner again rejected the claims on reference to the sound box horn combination patents, taken in connection with the disclosure of Lumiere, saying (A. F. W., 9),

> "The size of the diaphragm is held not a patentable limitation. Note, however, that Lumiere discloses a diaphragm exceeding nine inches in diameter."

Still insisting upon the patentability of his invention, and upon his right to adequate claims not literally restricted to particular dimensions, applicant amended the broader claims to define the area of the tympanum as (A. F. W., 10-13)

> "of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves"

which is the expression that appears in claim 4 of the patent. Of this definition he said (A. F. W., 14):

> "We respectfully solicit a careful consideration of the new claims 11 to 16 inclusive, which have been redrawn, following somewhat the form of new claims 1 and 2, to define a tympanum of such area as to produce directly regenerated sound waves substantially corresponding in intensity and amplitude to the recorded sound waves. That is to say, a tympanum adapted to regenerate by its own movements when vibrated by the record, the original sounds, without the interposition of any horn or other confining transformer."

And he argued that such a direct acting tympanum had long been sought for (as was evidenced by the flat sounding board patents to which the examiner had referred); that these prior art devices had not solved the problem; that the applicant had succeeded where others had failed, and that under these circumstances the examiner's idea that the change did not require invention is overcome by the historical facts. And he said (A. F. W., 15):

> "We believe that it will now be apparent to the Examiner that the selection of the particular dimensions is of the essence of the invention and attains novel results arising from the particular dimensions and such as could not be obtained by the devices shown in the references."

With that position taken by the patentee during the prosecution of his application, plaintiff, his successor in interest, is now wholly in accord. There is no doubt that size is of the essence of Hopkins' invention, in its differentiation from the sound box horn devices of the prior art. Nor does there seem to be any doubt that the particular dimensions set forth by Hopkins are essential to the character of faithful reproduction over the whole sound spectrum that the art demands. It seems to us there could be no greater assurance of the intelligence and importance of Mr. Hopkins' experimental work, of the value of his specific disclosure, and of the really remarkable character of his simple mechanical combination, than the fact that defendant selects the very size of cone that Hopkins indicated to be necessary, achieving reduction of the nine-inch over-all diameter of the tympanum only by reducing the width of the rim and compensating for that by choosing a more flexible material.

Defendant did this after the Hopkins patent had repeatedly been held valid and had been held to be infringed by the substantially identical Brandes loud speaker. And that choice was made in preference to adopting such competitive devices as had been held not to infringe by a Circuit Court of Appeals (Western Electric double cone) or by a District Court (Crosley type).

It might very well be asked: What leads defendant to manufacture this particular single cone type of loudspeaker, in these modern days of ample power and excellent sound reproduction, except the latent virtue of that simple combination? And what leads defendant to choose that particular size of cone except the accuracy of Hopkins' experimental observation that sounds will not be reproduced in balanced volume over the whole range of frequencies if the cone is reduced below the size he indicated?

In the third office action on the Hopkins application, the examiner expressing doubt that the Hopkins structure would "by itself" produce sound waves corresponding in intensity to the recorded sound waves, again rejected the claims on the ground that Hopkins had made no invention over Lumiere's large diaphragm in view of the small conical diaphragm of the sound box horn combination patents (A. F. W., 16-17).

Responding to that repeated rejection, the applicant inserted in some of the claims the words of negative limitation—"without an amplifying horn or chamber".* Discussing the amended claims, the applicant's solicitors said that the purpose of the amendment (A. F. W., 18)—

> "is consistent with the purpose which we have continually followed, that is, to distinguish the present machine from the ordinary machine in which the regenerator comprises a reproducer and a trumpet. In the opening part of the specification, we tried to make it clear that in ordinary machines, the reproducer, or sound box, is incapable of generating sound waves of such a character as will persist in the air to any substantial extent. The character of the sound made by an ordinary phonograph sound box disconnected from the amplifying horn or chamber, is well known to the Examiner, and is, of course, easily distinguished in his mind from the sound produced by the sound box acting together with the amplifying horn or chamber. It has been demonstrated to the Examiner that the applicant's machine, without any amplifying horn or chamber, will produce a volume of sound which corresponds to the sound produced by the conjoint action of the sound box and amplifying chamber in an ordinary phonograph. In other words, the applicant's ma-

*These words were subsequently erased as unnecessary (A. F. W., 24).

chine does, with its large diaphragm, what the old machines do with the combined diaphragm and amplifying horn or chamber, and in so doing the applicant's machine overcomes the limitations which necessarily reside in the use of a horn or chamber. This accomplishment is a perfectly definite thing which anyone can understand, which has often been tried before, and which is done by the applicant for the first time. We have done everything we possibly could do to define this distinction in the claims, and it seems to us that they do define it. The additional words inserted in the claims have not been inserted with the intent or purpose of changing their scope, nor is it intended that they shall in any way result in prolonging the prosecution of the case. They are merely an earnest of our purpose to distinguish definitely from the old machines in which an amplifying horn or chamber is used."

This statement of purpose was followed by a repetition of the argument that applicant's invention is not anticipated by Lumiere, or by the sound-box horn combination patents, or by any permissible adding together of the disclosure of those references.

In the fourth office action the examiner again rejected the claims, but this time on the ground that the definition of size was too indefinite, saying (A. F. W., 20):

"The specification of the size according to results is believed to be too indefinite. The examiner understands that the base diameter and the altitude must have a definite relative proportion, and that the base diameter must be *substantially* nine inches in order that satisfactory results can be obtained. * * * The statement in some of the claims that the diameter exceeds nine inches is not believed to be sufficiently definite." (Emphasis ours.)

In the fourth amendment (A. F. W., 21) the words "of large area rigidly supported at its periphery and freely exposed to unconfined air" were inserted in claims 1 and 2. In claims 11 and 12 (claims 7 and 8 of patent 1,271,527) the words "of large area" were inserted after the word "tympanum." * Only claims 14 and 15 (claims 10 and 11 of patent 1,271,527) were amended to define the area as "exceding nine inches in diameter." At the same time some of the claims were amended to specify a rigid support for the outer edge of the tympanum (cone plus rim).**

In the argument accompanying that amendment, language was used that shows, it seems to us, the wisdom of the rule that things said in argument do not give rise to estoppel. The *act* of applicant's solicitor at that time was an insistence upon claims not limited in terms to an over-all diameter of tympanum (cone plus rim) of nine inches. Nevertheless in argument, the solicitor's *words* were (A. F. W., 21):

> "It is essential to the success of applicant's machine that the tympanum be of large area and that the base of the *vibratile portion thereof* exceed nine inches in diameter, and furthermore that the peripheral edge of the tympanum, *exterior of the vibratile portion,* be rigidly secured * * *."

And:

> "Applicant has demonstrated that his invention is not wholly satisfactory when the conical tym-

*These words were erroneously printed as "of long area" in the patent and were corrected by certificate of correction (Pat. 1,271,527, p. 8).

**That was done because the examiner had called the applicant's attention orally to prior art patents showing horns or other amplifying devices made of paper or the like, but without any rigid support or interposed flexible rim (A. F. W., 23-24).

panum is made with a *basal diameter* of less than nine inches." (Emphasis ours.)

The fact is that it is not, and never was, anywhere suggested in the specification of the patent that the basal diameter of the conical portion of the tympanum should exceed nine inches. The reference in the patent is to the over-all diameter of the tympanum, including the conical "vibratile portion thereof" plus the rim "exterior of the vibratile portion."* As to the basal diameter of the conical portion, the patent says that it should exceed in area one-half of the effective area of the entire tympanum, which entire tympanum is to have a diameter of nine inches.

Would anyone suggest that this hasty and erroneous statement twice made by applicant's attorney in this argument could have the effect to arbitrarily limit the scope of the monopoly?

Is it not a reasonable interpretation of the positively erroneous language thus used in argument, that the solicitor meant only to say what the specification says; what the solicitor had earlier said in argument, and what the examiner had said he understood to be a fact; that the cone plus the rim must be **substantially** nine inches in diameter to produce the desired result.

If defendant by the same combination of three mechanical elements had succeeded in producing the same result with a tympanum slightly less than nine inches in diameter having a conical portion slightly less than one-half the area of a nine-inch tympanum, it would even then seem to us that the Court would find infringement on the ground that defendant had adopted the principle of the Hopkins invention, sacrificing some of the desir-

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*See discussion by Campbell, D. J., in the *Sylo case* (Pamphlet, p. 6).

able character of reproduction, but nevertheless making substantial use of the patented subject-matter.*

But where, as here, defendant carefully preserves the specified area of the conical sound-producing portion of the tympanum, and effects only a colorable diminution of the over-all diameter by substituting a narrower rim of more flexible material for a wider rim of less flexible material, it seems to us that the diminution in size is too apparent a subterfuge to deceive a tribunal that judges rights on the basis of substance and fair dealing.

That the applicant's solicitor was consistently and deliberately insisting on claims not limited, even in terms, to an over-all diameter of nine inches is shown by the statement in this argument (A. F. W., 23) that

> "* * * and in **some** of the claims, the lower limit of the diameter of the vibratile portion of the tympanum is set forth." (Emphasis ours.)

In this final argument, the applicant insisted (A. F. W., 22) that the expression—

> "the vibratile conical tympanum is of large area rigidly supported at its periphery and freely exposed to unconfined air, so that when the tympanum is vibrated, it imparts to the surrounding free air, sound waves corresponding in intensity to the recorded sound waves"

was sufficiently definite to differentiate Hopkins' direct-acting loudspeaker from the sound-box and horn devices. Thereupon the examiner yielded and allowed the claims abandoning the idea that no invention was involved and also the objection that the chosen language of the claims was indefinite.

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*Sewall vs. *Jones*, 91 U. S., 171, 183-184; *Winans* vs. *Denmead*, 15 How., 330, 344.

After this final argument was filed and immediately before allowance, the applicant divided out of the parent application the claims covering the acoustic device *per se*, and incorporated them in the divisional application which resulted in the patent in suit.

As originally filed, the divisional application contained thirteen claims of which claims 1 to 7 correspond to claims 1 to 7 of the patent. Claims 8 to 11 and 13 were limited to a particular material for the tympanum, and claim 12 defined the size by the words (A. F. W., 25):

> "said conical portion being of sufficient area to impart to the surrounding free air, when vibrated, sound waves substantially corresponding in intensity to the original shocks or vibrations."

The claims limited to a particular tympanum material were subsequently canceled and claim 12 was replaced by claim 8 of the patent (A. F. W., 25).

There was in the history of this divisional application no further discussion of the claim language which had already been accepted by the Examiner.

In this insistence upon the patentability of his large-area, direct-acting sounding-board combination over the old sound-box and horn combination patents, and search for and finding of an appropriate definition of size, there is no confirmation of defendant's interpretation of the patent disclosure which seeks to limit it to a tympanum made of one piece of strong, crisp material throughout; or of any absolute limitation to a nine-inch over-all dimension without any range of equivalents. **It could only have been in contemplation of possible equivalents that applicant insisted upon, and the examiner allowed, the claims of broader phraseology.**

We do not particularly contest defendant's suggestion that both forms of claim phraseology were intended to define the size and proportions disclosed in the speci-

fication.* But it seems plain to us that the mere struggle for allowance of two forms of expression in the claims is confirmatory of our own interpretation of the specification—that it permits some latitude of equivalents, certainly including defendant's compensated change in the form of the rim which preserves both the specified size of the cone and the desirable flexibility of the rim. In the specification it is expressly said that some departure from the approximate sizes given is permissible (Pat., p. 2, lines 97, et seq.).

The Proper Test of Infringement.

We concede that correspondence with the letter of the claims does not settle conclusively the question of infringement; that a charge of infringement is sometimes made out though the letter of the claims be avoided, and that the converse is equally true.[1] The true inquiry is: What mode of operation is introduced and employed, and what result is attained by the structure or device illustrated and described as the preferred embodiment of the invention[2], and whether defendant's combination of elements performs substantially the same function in substantially the same way to obtain the same result?[3] If the answer to this inquiry is in the affirmative, infringement will be found unless the patentee has so manifested an intention to disclaim part of his true invention as to exclude defendant's structure.[4]

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*If claims 4 and 8 were not in the patent, we should nevertheless confidently expect this Court to find infringement of the other claims, which are limited in terms to the nine inch over-all diameter; since there is not anything in the true nature of the Hopkins invention, or in the prior art, to exclude the obviously equivalent structure adopted by defendant.

[1]*Westinghouse* vs. *Boyden*, 170 U. S., 537, at page 568.

[2]*Winans* vs. *Denmead*, 15 How., 330, at pages 338-339.

[3]*Machine Co.* vs. *Murphy*, 97 U. S., 120, at page 125.

[4]*Winans* vs. *Denmead*, supra.

The answer to the inquiry as to the true mode of operation and result of the patented invention, in the instant case, is as we have stated it (*ante*, pp. 14-17). The large light paper cone, because of its little inertia accompanied by stiffness, is capable of responding to the high frequency sound vibrations and of imparting them to a large body of air. That capacity is preserved, and at the same time the deformation of the cone is prevented, by the flexible rim. The rigid frame affords a mechanical support and protection for the entire structure, and by the interposition of the flexible rim is prevented from inhibiting the bodily sound-producing motion of the cone. The result is an efficient direct-acting loudspeaker. We think that it is impossible to deny that defendant's combination of elements performs substantially the same function in substantially the same way to obtain the same result.

Indeed, we think that conclusion, which was in fact accepted by the Court of Appeals of the Ninth Circuit (footnote ante, p. 20), is explicitly stated even in the testimony of defendant's own expert, who said (Tr., 52):

> "As to the structural differences and the differences in operation and effect as between the defendant's device and the device shown in the Hopkins patent in suit—both devices generate the sound at the apex of the cone, and in substantially the same manner.† * * * In the Hopkins construction he makes the periphery flat to form an annular rim and clamps it to a rigid frame of large mass. In our construction we interpose a flexible yielding and resistive membrane of kid leather between the edge of the cone and the supporting rim."

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†Here defendant's expert testified that in his replica of the Hopkins construction (Deft.'s Ex. 17) blasting and rattling occurred. But in rebuttal (Tr., 91-92) it was shown that the rattling in that exhibit was due to the striking of an unbalanced armature against the magnet pole pieces and was not the blasting effect of the edge of the cone.

(Tr., 53:)

> "When sound vibrations reach that flexible kid membrane, the softness and yielding qualities of it cause it to absorb a great proportion of that sound, and cause it to absorb and prevent the bulk of that rattling."

And (Tr., 65-66):

> Q. "Why don't you support your cone by a rigid frame clamped directly to the edge of the cone, instead of having this interposed flexible rim?
> A. To enable the cone to vibrate freely and move freely.
> Q. That is, if the edge of the cone was supported to a rigid structure it could not vibrate freely, and could not produce sound freely; is that true?
> A. It could produce sound at certain frequencies.
> Q. But not low?
> A. But not the lower frequencies."

The Decision and the Opinion of the Court of Appeals in the Instant Case.

Neither the position of the defendant in the Court below, nor the decision in that Court, rested upon this mere diminution of the over-all diameter of the tympanum by a narrowing of the rim.

Both went beyond that to the conclusions that the patent must be limited to a rim which is an integral peripheral extension of the paper cone.

Defendant in its brief below took the position (brief, p. 36) that the patent

> "* * * while valid when narrowly construed, must be limited to a tympanum characterized by a matter

> of size exceeding nine inches in diameter, *and* the use of a material throughout which is to be crisp and strong and possessing considerable rigidity.
>
> This applies not only to the conical portion but to the so-called plane peripheral portion which makes up a substantial part of the sounding-board of the Hopkins device." (Emphasis ours.)

And (brief, p. 46):

> "The patent discloses a unitary, integral tympanum, and only such a tympanum. It comprises two portions, the cone and the rim, but the teaching of the patent is that the two portions shall be formed of a single piece, and that the whole shall be of crisp vibratile material."

The Court of Appeals, as we have seen, rested its narrow interpretation of the patent upon a consideration of the prior art; holding that defendant's flexible non-resonant rim or annulus is not the equivalent of the flat rim or plane annulus of Hopkins' tympanum, and that the patentee's claims are void for lack of invention unless the claims are limited to exclude "the smaller device of appellee, *with its limp leather annulus.*" (Emphasis ours.)

We think it would serve no useful purpose for us to discuss in detail the wandering opinion, written by Wilbur, C. J., in which this conclusion is expressed. Nowhere in it is Hopkins' simple mechanical three-element combination appreciated. The true mode of operation and quality of result is found, as matter of fact (Tr., 114-115 and 118), but is not used as a measure of scope; being erroneously put aside on the ground that functional elements of the total result were separately present in earlier structures,* and upon the unreasonable

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*Temco, etc., Co. vs. Apco, etc., Co., 275 U. S., 319, 325-6.

idea that infringement of a mechanical combination patent depends upon whether the patentee did or did not mention all of its advantages. It violates reality by disregarding the fact that an invention, like life itself, is "to be viewed eventually as a whole, not analyzed to parts, but each part having reference to all." It repeatedly disparages the invented combination on the ground that "practically every element in the Hopkins patent was known to the prior art" (Tr., 127).* It does even worse than that, repeatedly suggesting that prior art devices, because they produce partial results which are only functional elements of Hopkins' total result, are anticipatory; as though results were patentable, as distinguished from structure.* It erroneously distinguishes defendant's device from the patented device on the ground that "The Rola cone * * * is too small" (Tr., 117-118) "* * * using a smaller cone than Hopkins thought possible" (Tr., 128), although the Rola cone is in fact larger than the minimum specified by Hopkins.** It is over-solicitous as to the right of the public to use devices of the prior art; whereas plaintiff could have, and has, no complaint to make about that, complaining only of the use of the patented combination. It distorts the rule that "That which infringes if later would anticipate if earlier" into the untenable idea that patents which, if still unexpired, might be infringed by an improved combination are anticipatory thereof. It distorts the rule that accidental and unappreciated use does not anticipate into the erroneous thought that a patentee must mention all of the advantages that inhere in his disclosed structure. It erroneously suggests that subse-

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Temco, etc., Co. vs. *Apco, etc., Co.*, 275 U. S., 319, 326.

**See Hazeltine's correction of the erroneous notions of defendant's counsel on this subject (Tr., bottom p. 33 and p. 34), and Farrand's repetition of the same correction (Tr., 106). It seems to us discouraging to the point of hopelessness that error should appear on this fact which can be determined merely by looking at defendant's cone.

quent improvements (the baffle, Tr., 128*) added to the patented structure avoid infringement.** And after saying that the Appellate Court "must rely upon the judgment of the Trial Court as to what was demonstrated before it" (Tr., 131), the opinion repeatedly makes assertions about demonstrations which the Trial Court in its opinion completely ignored (Tr., 13-20) after warning counsel for both sides (Tr., 46 and Tr., 94) that it would ignore such demonstrations if, upon consideration, they seemed immaterial.

The Fundamental Error.

But, laying all that aside, the disagreement between the decision of the Court of Appeals in the instant case and the decision of the Court of Appeals of the Third Circuit is, after all, a result of a different viewpoint as to the range of equivalents to which the patent is entitled, deduced from a different viewpoint as to the standing of Hopkins' invention in the art.

If we think of the art of sound reproducing devices generally, it is a crowded art, and Hopkins' patent stands in it as one which deflected the public demand and the responsive industrial production of sound reproducing devices from the sound box and horn combination to direct-acting loud speakers of the cone type.

If we think of the art, more specifically, as the art of cone type loud speakers, Hopkins' patent stands in it as the step that made the scientifically correct Starling & Cole idea a practical commercial reality by adding to their direct-acting cone a rigid supporting frame coupled to the cone by a flexible rim.

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*And see defendant's witness Danielson (Tr., 71-72) and plaintiff's expert, Hazeltine (Tr., 94).

**_Temco, etc., Co._ vs. _Apco, etc., Co._, 275 U. S., 319, 328.

The Court of Appeals in the instant case never reached any appreciation of this reality. It fell into the error corrected by this Court in the *Paper Bag case.** Having found the Hopkins invention of less than pioneer character the Court of Appeals erroneously proceeded to restrict it to that form which the patentee describes as the best mode of applying the principle of his invention without appreciating the true nature of the Hopkins invention, or making any adequate comparison of that with defendant's structure.

There has always been a tendency to simplify questions of patent infringement by dividing all patents into two classes (1) those for primary inventions or so-called "pioneer" inventions and (2) those for improvement inventions in a crowded art; and to confine the application of the doctrine of equivalents to the first class.

This procedure found some support in the early decisions of this Court and some of the lower courts proceeded to carry it too far. For instance, the lower courts followed the decision in *Miller* vs. *Eagle*, 151 U. S., 134, until things got to a point where patent lawyers urged, as matter of law, that patents could be divided into these two arbitrary classes and that the doctrine of equivalents is applicable only to the first class.

This substituted terminology for reality. It sought to divide into two sharply defined classes inventions which in reality have an infinite variety of individuality, in some degree "pioneer" and in some degree "improvement," and which differ from one another by infinite gradations all the way from the really pioneer inventions that create a new art, like Morse's telegraph, Bell's telephone and Marconi's wireless telegraphy, to the last step inventions that merely smooth out the path and renew arrested progress.

**Continental, etc., Co.* vs. *Eastern*, 202 U. S., 405, 415.

As this facile and correspondingly attractive idea was increasingly applied to practical cases, its error became more and more apparent; as it always does become finally apparent that the mere tagging of a thing with an arbitrary name satisfies only the superficial mind. The growing error was corrected by this Court in the *Paper Bag case* where the Court said (210 U. S., 415):

> "It is manifest, therefore, that it was not meant to decide that only pioneer patents are entitled to invoke the doctrine of equivalents, but that it was decided that the range of equivalents depends upon and varies with the degree of invention."

Since that time, and because it is always easier to accept broad generalities than actually to analyze a particular example, there has always been, and it begins to look as though there would always be, a tendency for the lower courts to return to the old doctrine. That tendency has, however, always been met by the logic and by the authority of the *Paper Bag case,* as has quite recently been evidenced by the practical application of the correct rule in *Temco, etc., Co.* vs. *Apco, etc., Co.,* 275 U. S., 319.*

The error of the old idea is quite beautifully illustrated in the case at bar where the Court of Appeals, after holding (Tr., 131) that a non-resilient flexible connection of the cone to a metal frame was anticipated in the sound-box horn combination patents, which also disclose a cone connected to a metal frame by a plane peripheral extension of the cone, nevertheless went on to save the patent from invalidity by restricting it to a plane peripheral rim. How the narrowing of the scope of the combination patent to a particular form of one element which was already old in that form increases the inventive concept involved, the opinion does not say.

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*And see *Eibel Co.* vs. *Paper Co.,* 261 U. S., 45, at page 63.

CONCLUSION.

We respectfully submit, therefore, that the decision of the Court of Appeals for the Third Circuit in the Brandes case was right, and that the decision of the Court of Appeals in the instant case is wrong and should be reversed.

Respectfully submitted,

WILLIAM H. DAVIS,
of Counsel.

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Abbreviated File Wrapper History Including All That Pertains to the Subject Matter in Issue.

(Cited as "A. F. W.")

Supreme Court of the United States

OCTOBER TERM, 1930.

No. 19.

LEKTOPHONE CORPORATION, *Petitioner,*

vs.

THE ROLA COMPANY.

OCTOBER TERM, 1930.

No. 68.

MILLER BROTHERS COMPANY, *Petitioner,*

vs.

LEKTOPHONE CORPORATION.

ON WRITS OF CERTIORARI TO THE UNITED STATES CIRCUIT COURTS OF APPEALS FOR THE NINTH CIRCUIT AND FOR THE THIRD CIRCUIT.

GALLO & ACKERMAN, Inc., 142 Liberty Street, 'Phones—Hitchcock 3078-9.

Abbreviated File Wrapper History Including All That Pertains to the Subject Matter in Issue.

Paper No. 1.

Original claims 15 to 20, inclusive, of the parent application (which eventuated in patent No. 1,271,527), were directed to the tympanum *per se,* and were as follows (Miller Record, p. 343)*

"15—**14**—A sound regenerator for directly propagating self-sustaining sound waves in air, consisting of a ponderous support having a circular aperture, a light vibratile tympanum having its outer edge mounted on said support, said tympanum being shaped to provide an annular plane adjacent said support and a conical portion springing from the inner edge of said annular plane, and a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum; substantially as described.

16—**15**—A sound regenerator for directly propagating self-sustaining sound waves in air consisting of a ponderous support having a circular aperture, a light tympanum mounted upon said support in said aperture, said tympanum having a central conical portion the base of which exceeds in area one-half the effective area of said tympanum; substantially as described.

17—**16**—A sound regenerator for directly propagating self-sustaining sound waves in air, consisting of a pon-

*All references to the transcript herein are to the Transcript of Record in *Miller Brothers Co.* vs. *Lektophone Corporation,* No. 68. That record was used for the present purpose because the Patent Office file wrappers contained therein are photographic copies and are easier to follow than the file wrappers in the record of the *Rola case.*

derous support having a circular aperture, a light vibratile tympanum exceeding nine inches in diameter having its outer edge mounted on said support, said tympanum being shaped to provide an annular plane adjacent said support and a conical portion springing from the inner edge of said annular plane, and a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum; substantially as described.

18—**17**—A sound regenerator for directly propagating self-sustaining sound waves in air consisting of a ponderous support having a circular aperture, a light vibratile tympanum mounted in said aperture and having its outer edge secured upon said support, said tympanum being shaped to provide an annular plane adjacent said support and a conical portion springing from the inner edge of said annular plane, the diameter of the base of said conical portion being substantially eight-tenths of the diameter of the said circular aperture in said support, and a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum; substantially as described.

19—**18**—A sound regenerator for directly propagating self-sustaining sound waves in air consisting of a ponderous support having a circular aperture, a light vibratile tympanum mounted in said aperture and having its outer edge secured to said support, said tympanum being shaped to provide an annular plane adjacent said support and a conical portion springing from the inner edge of said annular plane, the altitude of said conical portion being substantially one-quarter of the diameter of its base, and a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum; substantially as described.

20—**19**—A sound regenerator for directly propagating self-sustaining sound waves in air consisting of a pon-

derous support having a circular aperture exceeding nine inches in diameter, a light vibratile tympanum mounted in said aperture and having its outer edge secured to said support, said tympanum being shaped to provide an annular plane adjacent said support and a conical portion springing from the inner edge of said annular plane, the diameter of the base of said conical portion being substantially eight-tenths of the diameter of the said circular aperture in said support and the altitude of said conical portion being substantially one-quarter of the diameter of its base, and a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum; substantially as described."

Paper No. 2.

In the first office action, dated September 9, 1913 (Tr., 350), the examiner rejected these claims saying (p. 350):

> "What does applicant mean by 'self-sustaining sound waves?' "

and (Tr., 351-352):

"Claim 15 is rejected on Kraemer, June 9, 1908, 890,-142 (181-11).

Claim 16 is rejected on Kraemer; English, June 10, 1913, 1,064,062 (181-11); Edison, Feb. 22, 1910, 950,226 (181-10); Stroh, English patent, Feb. 16, 1901, 3,393 (181-10); Brown, English patent, Jan. 16, 1911, 1,157 (181-11) or Gaumont & Co. French patent, April 15, 1903, 331,226 (181-10).

Claim 17 is rejected on Kraemer. The size of the diaphragm is not a patentable limitation.

Claim 18 is rejected as not sufficiently distinguished from Kraemer.

Claims 19 and 20 are rejected on Gaumont in view of Kraemer. Note the dimensions of the diaphragm in figure 2 of Gaumont. No invention is found in providing Gaumont's device with a contact piece as at 16 in Kramer."

Paper No. 3.

In the first amendment dated, December 5, 1913 (Tr., 353), occurs the following discussion pertinent to the subject matter of claims 15 to 20 (Tr., 355-357):

"With reference as to what is meant on page 1 by 'self sustaining sound waves', and by 'high tension disturbances', it is pointed out that in ordinary phonographs or talking machines, a small diaphragm is mounted in a sound box containing a very small amount of confined air, and all of the energy of the record is projected against this small diaphragm, which is thus violently vibrated, thereby producing air disturbances of so high a tension, that these disturbances cannot, owing to the inertia of air, effect a movement of a sufficient volume of air to produce sound waves, which, after their production, will be self sustaining so as to carry to a considerable distance and produce sounds which correspond in character, timbre, volume and pitch to the original sounds which made the record, and which, therefore, are the original sounds regenerated.

Inasmuch as these high tension disturbances, which are produced by the small diaphragm in the confined air space of the sound box, cannot, owing to the inertia of air, produce sound waves of large area and of sufficiently low tension suitable for the sound conductivity of air, such sound waves will not be produced as correspond to the sounds which made the record. On the contrary, these high tension disturbances produced by the diaphragm will be squeaky, will have relatively high pitch, and will not be self sustaining so as to carry to any appreciable distance. It is for this reason that the horn or trumpet is employed to effect a lateral control of these high tension disturbances, resist their transformation into heat and convert them into waves of sufficiently low tension and large volume to enable them to overcome the inertia of the air and thereby become self-sustained.

But the use of the horn or trumpet amplifies the distortions produced by the small diaphragm being so violently agitated, and introduces distortions due to vibrations set up in the horn itself. The resultant sound waves are not true reproductions of the original sounds, but are the characteristic sounds known as 'phonograph sounds.'

In order to obtain faithful reproduction of the original sound waves, that is, to really regenerate the original sounds, applicant has provided a sound regenerating machine which dispenses with the employment of a horn or trumpet for transforming high tension disturbances into waves of lower tension, and in which the vibration of the stylus by the record are mechanically directly transmitted to a diaphragm which is free to vibrate in unconfined air, which has sufficient area to set in motion a large volume of air, which is sufficiently light and rigid to enable it to move in synchronism with the stylus, and the distance of vibration of which is sufficiently short to permit of a relatively slow movement appropriate for the sound conductivity of air, whereby the regenerated sounds will be self sustaining and will be accurate reproductions of the original sounds.

Applicant has thus produced a machine in which the sounds are regenerated directly from the record and in open and unconfined air, without the intervention of a sound box and its confined body of air, and without the intervention of any vibration transforming device, such as a horn or trumpet.

So far as applicant is aware the machine of this invention is the first which has ever been constructed which will accurately regenerate the original sounds without distortion, without squeaking, without accentuation of notes of certain pitch, without change in intonation and without any appreciable loss of energy, and which in fact will produce faithful reproductions of the original sounds.

With reference to the statement in lines 7 and 8 of page 8 that no wave motions are set up in the material of the cone portion of the diaphragm, it will be noted that the lower end of the rod V is rigidly secured to the cap M which is secured to the apex of the cone L. The vibrations which are imparted to the cone L through the rod V are mechanical movements which are transmitted directly from the stylus by the levers Q and R and the rods S and S'. The cone L is therefore moved bodily to and fro and is not molecularly vibrated, the diaphragm not being under tension, as are the transmission rods just referred to. The examiner, of course, understands that the sides of a cone being straight, will not yield when a blow strikes the apex of the cone in the direction of the axis thereof. If the diaphragm were flat where it is connected to the rod V, there would be a local vibration set up in the immediate vicinity of the connecting rod, but a large part of the diaphragm would not be bodily moved, as is the case with the cone, and the resultant sounds would be very feeble, and would not compare in volume to the sounds which are produced by the cone of the applicant's machine. Applicant has demonstrated this practically by employing both flat and conical diaphragms".

(Tr., 360-361).

"Each of the claims 15 to 20, inclusive, is drawn to the combination of elements therein set forth as combined in a sound regenerator for *directly propagating self sustaining* sound waves in air. Each of the devices of the references is an ordinary reproducer having a small diaphragm operating in a sound box having a small volume of confined air, and requiring, in order to set up self sustaining waves, the intervention of a transforming device, such as a horn or trumpet, to change the high tension vibrations into lower tension waves of greater amplitude. No one of the diaphragms described

and illustrated in the said references can be employed to directly propagate and regenerate the original sounds, but, the sounds produced therewith will be of high pitch and of so great a tension that the disturbances will not set up self sustaining waves in the air, for the reasons hereinbefore given.

For these reasons the references cited against claims 15 to 20, inclusive, do not meet the claims. With reference to claim 17 which specifies a tympanum exceeding 9 inches in diameter, it is submitted that the size of the tympanum is what enables it to effect direct regeneration of the sound. When a horn is employed for transforming high tension disturbances, the size of the tympanum is immaterial. Applicant has practically demonstrated that, to effect direct regeneration from the record of the sounds, a light, vibratile tympanum of substantially 9 inches in diameter or greater must be employed in order to obtain faithful reproductions".

(Tr., 362).

"The dimensions of the diaphragm and of the conical portion thereof, as set forth in claims 15 to 20, inclusive, are essential elements in a direct sound regenerator, but they are not essential in sound boxes which employ horns or trumpets as do all of the references which have been cited against these claims. This has been demonstrated by the applicant by actual trial.

For the foregoing reasons it is submitted that claims 15 to 20, inclusive, are not met by the references."

In this amendment the following claims 39, 40 and 41 were added (Tr., 365-366):

"39—**29**—*25*—In a sound regenerating machine, a tympanum having a free area exceeding nine inches in diameter and having a portion substantially eight-tenths of

the diameter of said free area which is rigid in the direction of the axis of the tympanum.

40—**30**—*26*—In a sound regenerating machine, a tympanum having a free area exceeding nine inches in diameter and having a conical portion substantially eight-tenths of the diameter of said free area.

41—**31**—*27*—In a sound regenerating machine, a tympanum having a free area exceeding nine inches in diameter and having a conical portion substantially eight-tenths of the diameter of said free area, the altitude of said conical portion being substantially one-quarter of the diameter of its base".

And also claim 57 (Tr., 368):

"57. In a sound regenerating machine, a tympanum having a conical vibratory portion adapted to be vibrated from a record, the tympanum having a vibratile area of sufficient size to effect, without amplification, the regeneration from the record of sound waves of relatively large volume and carrying power."

The amendment contains a discussion of these claims as follows (Tr., 374):

"Claims 39, 40, 41, 57, 61 and 65 distinguish from the references in the conical tympanum having a vibratile area of sufficient size to effect, without amplification, the regeneration from the record of sound waves of large volume and carrying power. Each of the references having a conical diaphragm, is of the sound box type having a small tympanum with a range of vibrations greater than that of the stylus and which requires a sound box and horn to transform the high tension disturbances produced into waves to which the air can respond."

By this amendment claims 15 to 20 were renumbered as **14** to **19** respectively SO THAT THE CLAIMS NOW IN INTEREST AT THIS POINT ARE NUMBERED **14, 15, 16, 17, 18, 19,** 39, 40, 41 and 57.

Paper No. 4.

In the second office action, dated February 7, 1914 (Tr., 377), the examiner rejected these claims saying (Tr., 378-379):

"Claim **14** is rejected as no invention is found in interposing any of the common non-vibratile members employed in this art between the diaphragm and stylus bar as in

Kraemer,	885,490,	Apr. 21, 1908,	(181-11),
Montgomery,	652,800,	July 3, 1900,	" "
Hill,	668,183,	Feb. 19, 1901,	(181-10), or
Berliner,	534,543,	" " 1895,	(181-3)

between the diaphragm and stylus bar of any such structures as in Gaumont, English, Edison, Browne, or Stroh, all of record.

Claim **15** is rejected on the references and for the reasons of record.

Claim **16** is rejected on the references and reasons of rejection of claim 14. The size of the diaphragm is held not a patentable limitation. Note, however, that Lumiere discloses a diaphragm exceeding nine inches in diameter.

Claims **17, 18** and **19** are rejected upon Gaumont of record, in connection with the considerations above given".

(Tr., 380).

"Claims 39, 40 and 41 are rejected on Gaumont or English, 1,064,062, in view of Lumiere, the selection of the particular dimensions being held not a matter of

invention in the absence of a showing of novel results arising from the particular dimensions and such as could not be obtained by the ratio of dimensions of the references. * * *

Claim 57 is rejected on Lumiere; also on any conical diaphragm cited in view of Lumiere."

Paper No. 5.

In the second amendment, dated February 5, 1915 (Tr., 382), the following claims were added (Tr., 383):

"1. In a machine for directly regenerating sound from a record of the same, a vibratile conical tympanum, and a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

2. In a machine for directly regenerating sound from a record of the same, a vibratile conical tympanum, a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum. the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves, and an open-work cabinet enclosing the tympanum but affording substantially free access of the surrounding air thereto; substantially as described."

Claims **14** to **19**, inclusive, were replaced by the following claims (Tr., 384-387):

"11—*7*—In a machine for directly regenerating sound from a record of the same, a tympanum support having a circular aperture, a light vibratile tympanum having

its outer edge mounted in said support, said tympanum being shaped to provide an annular sustaining rim adjacent said support, and a conical portion springing from the inner edge of said annular rim, a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum, and a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

12—*8*—In a machine for directly regenerating sound from a record of the same, a ponderous tympanum support having a circular aperture, a light tympanum mounted upon said support in said aperture, said tympanum having a central conical portion, the base of which exceeds in area one half the effective area of the said tympanum, and a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

13—*9*—In a machine for directly regenerating sound from a record of the same, a ponderous tympanum support having a circular aperture, a light vibratile tympanum exceeding nine inches in diameter, having its outer edge mounted on said support, said tympanum being shaped to provide an annular rim adjacent said support, and a conical portion springing from the inner edge of said annular rim, a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum, and a mechanical transmission through which

the vibrations produced by the record are transmitted to the tympanum, whereby the tympanum imparts to the surrounding free air sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

14—*10*—In a machine for directly regenerating sound from a record of the same, a ponderous tympanum support having a circular aperture, a light vibratile tympanum mounted in said aperture and having its outer edge secured upon said support, said tympanum being shaped to provide an annular rim adjacent said support, and a conical portion springing from the inner edge of said annular rim, the diameter of the base of said conical portion being not less than eight-tenths of the diameter of the said circular aperture in said support, a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum, and a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

15—*11*—In a machine for directly regenerating sound from a record of the same, a ponderous tympanum support having a circular aperture, a light vibratile tympanum mounted in said aperture, and having its outer edge secured to said support, said tympanum being shaped to provide an annular rim adjacent said support, and a conical portion springing from the inner edge of said annular rim, the altitude of said conical portion being substantially one fourth of the diameter of its base, a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum, and a

mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, the tympanum being of sufficient area to impart to the surrounding free air, when the tympanum is so vibrated, sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described.

16—*12*—In a machine for directly regenerating sound from a record of the same, a ponderous tympanum support having a circular aperture exceeding nine inches in diameter, a light vibratile tympanum mounted in said aperture, and having its outer edge secured to said support, said tympanum being shaped to provide an annular rim adjacent said support, and a conical portion springing from the inner edge of said annular rim, the diameter of the base of said conical portion being not less than eight-tenths of the diameter of said circular aperture in said support, and the altitude of said conical portion being substantially one quarter of the diameter of its base, a cap of non-vibratile material rigidly secured to the apex of said conical portion of said tympanum, and a mechanical transmission through which the vibrations produced by the record are transmitted to the tympanum, whereby the tympanum imparts to the surrounding free air sound waves substantially corresponding in intensity to the recorded sound waves; substantially as described."

The numerals of claims 39, 40 and 41 were changed to **29, 30** and **31,** and claim 57 was cancelled, SO THAT AT THIS POINT THE CLAIMS IN INTEREST ARE NUMBERED 1, 2, 11, 12, 13, 14, 15, 16, **29, 30** and **31.**

The same amendment contained the following discussion of these claims:

(Tr., 388).

"New claims 1 and 2 will, perhaps, bear upon their faces the distinguishments relied upon, but they will hereinafter be discussed in connection with the redrawn claims numbered 11 to 16".

(Tr., 389, 390 and 391.)

"We respectfully solicit a careful consideration of the new claims 11 to 16, inclusive, which have been redrawn, following somewhat the form of new claims 1 and 2, to define a tympanum of such area as to produce directly regenerated sound waves substantially corresponding in intensity or amplitude to the recorded sound waves. That is to say, a tympanum adapted to regenerate by its own movements when vibrated by the record, the original sounds, without the interposition of any horn or other confining transformer. The Examiner will recognize, we believe, that such a tympanum has long been sought for by those most skilled in the art, and this is evidenced by the patents cited, such as Shanks, Amet and Lumiere. Those patented devices were certainly failures, and, so far as we are aware, no one before the present applicant succeeded in producing such a tympanum. That the applicant has fully succeeded we can prove to the Examiner by demonstration, if he so desires. It is suggested that size is not a patentable limitation, and that in any case Lumiere disclosed a diaphragm more than nine inches in diameter. The fact is that the problem which the applicant endeavored to solve does not exist until the tympanum is made of very large diameter, that is, of diameter large enough to regenerate the original sounds. When work is attempted on such a large diameter it is found that the diaphragm vibrates at different rates and different intensities in different parts, so that it is divided into nodes of great activity, alternating with portions of little or no activity. Lumiere encountered this difficulty and attempted to solve the problem by the

structure disclosed in his patent No. 986,477. We believe it can easily be proved that that attempt was a failure. The Lumiere patent belongs to the Victor Talking Machine Company, but that Company has never put upon the market any machines embodying the invention. However that may be, the applicant's claims are carefully distinguished from Lumiere, which is not cited directly as a reference against them. In our opinion the suggestion that there is no invention in the form of regenerating tympanum devised by the applicant, is entirely refuted by the Lumiere patent. If the small reproducer diaphragms of conical shape were in themselves sufficient to show those skilled in the art that the difficulties encountered by Lumiere could be overcome by adopting the form of tympanum adopted by the applicant, then Lumiere would have adopted that form. The fact is that the applicant has succeeded where others, and those most skilled in the art, have failed, and under those circumstances deductions which might otherwise be drawn from the earlier different, but now suggestive, patented structures, are overcome by the historical fact. We do not believe that the Examiner is justified in rejecting the applicant's tympanum claims unless he can find in the prior art a structure which in itself corresponds to those claims.

With respect to old claims 39, 40 and 41, now numbered **29, 30** and **31,** we ask the Examiner to take into consideration the foregoing remarks. We believe that it will now be apparent to the Examiner that the selection of the particular dimensions is of the essence of the invention and attains novel results arising from the particular dimensions and such as could not be obtained by the devices shown in the references. If the Examiner desires to hear the results, we can arrange to make a demonstration for him here in New York, paying his traveling expenses for that purpose, or perhaps we can

arrange to have one of the machines taken to the Patent Office."

Paper No. 6.

In the third office action, dated February 23, 1915, the examiner again rejected the claims, saying:

(Tr., 392-393).

"It is doubtful to the examiner if a structure as disclosed by applicant will by itself produce sound waves corresponding in intensity to the recorded sound waves, as such requires that the entire energy represented by the recorded waves be transmitted without loss of energy to the diaphragm and that the diaphragm offer substantially no resistance to the movement so transmitted. If applicant insists on claims embodying such a limitation, he should satisfy this office by competent affidavits or by demonstration that such is true.

Claim 1 is rejected on Lumiere, of record, in view of the conical diaphragms of record. As such conical diaphragms are designed to be transversely rigid and operate in producing sound analogously to a piston, there would seem to be no apparent limit within a moderate range on the diameter which could be employed. Therefore, to increase the diameter of any such diaphragm, as in the references cited, to perform an old function where there is no apparent limit to the diameter that may be employed, is not seen to be a display of invention. In re Pein, 201 O. G., 570.

Claim 2 is rejected on the above references and reasons. No invention is seen, further, in enclosing Lumiere, or a similar structure, in a cabinet, especially in view of Miller of record, Fig. 6, or such structures as in

> Eckhardt 903,364, Nov. 10, 1908 (181-3), or
> Zappert, English, 17,827, July 31, 1909 (181-3), 1 sheet".

(Tr., 393-394).

"Claims 11, 13, 14, 15 and 16 are rejected on the grounds of rejection of claim 1. The interposition of the cap of non-vibratile material in Lumiere, or any other type of diaphragm substituted in Lumiere, is not seen to involve invention, in view of the common use of such in the art, for the same purpose as it is employed by applicant.

* * * * * * *

Claims 29, 30 and 31 are rejected on Lumiere, in view of the conical diaphragms of record, for the reasons above given."

Paper No. 7.

In the third amendment, dated February 22, 1916, the following instructions were given for amending claims 1, 2, 11, 12, 13, 14, 15 and 16 (Tr., 395):

"In the second line of claim 1 and the second line of claim 2, after the word 'same' insert:—without an amplifying horn or chamber—and make the same insertion in the second line of claim 11, claim 12, claim 13, claim 14, claim 15 and claim 16."

This amendment contained the following discussion of the claims now in interest (Tr., 395-398):

"In the last Office Action the Examiner expressed doubt whether the structure disclosed by applicant will itself produce sound waves corresponding in intensity to the recorded sound waves 'as such requires that the entire energy represented by the recorded waves be transmitted without loss of energy to the diaphragm and that the diaphragm offers substantial non-resistance to the movement to be transmitted' and called for affidavits or a demonstration. A demonstration of the machine was made to the Principal Examiner and his assistant

last week, and we believe they were satisfied that the machine would produce, without an amplifying horn or chamber, sound waves substantially corresponding in intensity to the original recorded sound waves. Of course, the Assistant Examiner who wrote the last Office Action was mistaken in supposing that there is any necessary relation between the energy represented by the recorded waves and the energy delivered to the air by the diaphragm. Only a minute part of the energy of the recorded waves is gathered in by the recording trumpet and made use of to actuate the recording device. The energy put upon the air by the vibrating diaphragm is not at all the same energy that existed in the recorded waves, but is the energy of the motor which drives the record tablet in the reproducing machine.

We have amended claims 1 and 2 and claims 11 to 16, inclusive, to emphasize the fact that the machine has no horn or amplifying chamber. We do not believe that the Examiner will suggest that this is a negative limitation, and its purpose is consistent with the purpose which we have continually followed, that is, to distinguish the present machine from the ordinary machine in which the regenerator comprises a reproducer and a trumpet. In the opening part of the specification, we tried to make it clear that in ordinary machines, the reproducer, or sound box, is incapable of generating sound waves of such a character as will persist in the air to any substantial extent. The character of the sound made by an ordinary phonograph sound box disconnected from the amplifying horn or chamber, is well known to the Examiner, and is, of course, easily distinguished in his mind from the sound produced by the sound box acting together with the amplifying horn or chamber. It has been demonstrated to the Examiner that the applicant's machine, without any amplifying horn or chamber, will produce a volume of sound which corresponds to the sound pro-

duced by the con-joint action of the sound box and amplifying chamber in an ordinary phonograph. In other words, the applicant's machine does, with its large diaphragm, what the old machines do with the combined diaphragm and amplifying horn or chamber, and in so doing the applicant's machine overcomes the limitations which necessarily reside in the use of a horn or chamber. This accomplishment is a perfectly definite thing which anyone can understand, which has often been tried before, and which is done by the applicant for the first time. We have done everything we possibly could do to define this distinction in the claims, and it seems to us that they do define it. The additional words inserted in the claims have not been inserted with the intent or purpose of changing their scope, nor is it intended that they shall in any way result in prolonging the prosecution of the case. They are merely an earnest of our purpose to distinguish definitely from the old machines in which an amplifying horn or chamber is used.

We hardly know what we can say in regard to that paragraph of the Examiner's letter which suggests that the applicant's accomplishment does not involve invention. As we understand it, the argument is that Lumiere proposed to use a large diaphragm, but not a conical diaphragm; that small conical diaphragms are old in sound boxes, and that consequently there is no invention in using a large conical diaphragm. It seems to us that this proposition need only be stated to refute itself. The fact is that, although small conical diaphragms were old in sound boxes, Lumiere, who is one of the most skilled men in the art, not only did not know that a large conical diaphragm would accomplish his purpose, but was unable to accomplish that purpose at all. The Lumiere patent is owned by the Victor Talking Machine Company and it is well known to those skilled in the art that the suggestions of Lumiere were abortive and never resulted in an operative machine. The applicant's claims clearly

differentiate from the Lumiere patent and that is all that is necessary. On the question of invention the Lumiere patent is pertinent to the present discussion only because it shows that prior to the applicant, the art did not know how to accomplish the applicant's result.

This ground of rejection was applied by the Assistant Examiner to claims 1, 2, 11 to 16 inclusive and **29, 30** and **31,** and we do not believe that the present Examiner will insist upon it with respect to any one of those claims."

Paper No. 8.

In the fourth office action dated March 4, 1916, claims 1, 3, 11 to 16 and **29** to **31** were again rejected as follows (Tr., 405):

"Claims 1, 3, 11 to 16 and **29** to **31** are rejected as indefinite. The specification of the size according to results is believed to be too indefinite. The examiner understands that the base diameter and the altitude must have a definite relative proportion, and that the base diameter must be substantially nine inches in order that satisfactory results can be obtained. To merely specify this size by the result is believed to be too indefinite. The basis of reference which is stated to be the recorded sound waves is believed to be an indefinite reference base, and that such a range would be too great and variable to be readily determined. For instance, a limitation such as from eight to ten inches for the base diameter might be given. The statement in some of the claims that the diameter exceeds nine inches is not believed to be sufficiently definite. If it is immaterial what the size is within a considerable range, then it is a mere question of expediency, or selection of any size one desires for any loudness, and would not involve invention."

Paper No. 9.

In the fourth amendment, claims 1, 2, 11 to 16 inclusive, and **29** to **31** inclusive, were amended as follows (Tr., 407-408):

"Claims 1 and 2, line 3, after 'panum' insert:—of large area rigidly supported at its periphery and freely exposed to unconfined air—.

Claims 11 and 12, line 3, after 'tympanum' insert:—of large area—.

Claim 11, line 4, before 'mounted' insert:—rigidly—.

Claim 12, line 4, before 'mounted' insert:—having its outer edge rigidly—.

Claims 13, line 5, before 'mounted' insert:—rigidly—.

Claim 14, line 3, after 'aperture' insert:—exceeding nine inches in diameter—. Line 4, before 'secured' insert:—rigidly—.

Claim 15, line 3, after 'tympanum' insert:—of large area—. Line 4, before 'secured' insert:—rigidly—. Line 6, after 'support,' insert:—the inner diameter of said rim exceeding nine inches—.

Claim 16, line 5, before 'secured' insert:—rigidly—.

Claims **29**, **30** and **31**, line 1, after tympanum insert:—rigidly supported at its periphery—."

The same amendment contained the following discussion (Tr., 408-409-410):

"The foregoing amendments are made as the result of an oral interview recently had with the Examiner, at which it was agreed that the said amendments would not only more clearly define the invention, but would also render the material distinctions between the same and the prior art, including a number of patents which show horns or amplifiers of paper or other similar material directly associated with the reproducer needle, clearly apparent. It is essential to the success of applicant's machine that the tympanum be of large area and that the base of the vibratile portion thereof exceed nine inches in diameter, and furthermore that the peripheral edge of the tympanum, exterior of the vibratile portion, be rigidly secured or tightly gripped between the rings

of the supporting frame. These definitions of the essential characteristics of the invention have been included in the claims by the amendments aforesaid, and said claims are, therefore, believed to be allowable.

The Examiner's objection that applicant indicates only the lower limit of the diameter of the tympanum and does not include both limits, is believed to be without substantial foundation. Applicant has demonstrated that his invention is not wholly satisfactory when the conical tympanum is made with a basal diameter of less than nine inches. He has also found that tympanums of much larger diameter are eminently successful, but he is not prepared to even indicate any maximum limit in respect of such diameter, nor should a statement of such an upper limit be required. He has produced a highly successful device which is novel and useful, and as the prior art discloses no similar device either structurally or operatively considered, it is submitted that he has properly defined his invention in the claims, when he has distinguished the device, as so defined in the claims, from the prior art.

For example, in claims 1 and 2, it is stated that the vibratile conical tympanum is of large area rigidly supported at its periphery and freely exposed to unconfined air, so that when the tympanum is vibrated, it imparts to the surrounding free air, sound waves corresponding in intensity to the recorded sound waves. At a recent demonstration before the Examiner and his assistants, at the offices of applicant's attorneys in this city, it was made clearly manifest that the machine embodying the present invention did reproduce sounds or sound waves substantially corresponding in intensity to the recorded sound waves. The demonstrating machine was without any amplifying devices whatever in the form of a horn or sound-box, and the Examiner will recall that the sounds reproduced were clear, resonant, self-sustained

and of admirable quality and timbre, and of an intensity which obviously approximated that of the recorded sound waves. It is, therefore, believed that the expression 'substantially corresponding in intensity with the recorded sound waves' is correct and perspicuous and can give rise to no uncertainty or ambiguity. Of course, the term *substantially* implies a certain latitude, which the facts in the case would appear to justify, as all of the reproductions of recorded sounds by applicant's machine clearly indicate to the ordinary ear that they necessarily approximate the recorded sounds not only in intensity, but in timbre and quality.

In the other claims, as amended, the characteristic feature of mounting or supporting the outer edge of the vibratile tympanum rigidly on a support is brought out, and in some of the claims, the lower limit of the diameter of the vibratile portion of the tympanum is set forth, and as all of these amendments go to structure and differentiate such structure from the prior art, it is urged that the claims are no longer open to the objection of indefiniteness.

In respect of the prior art patents, not of record, but to which attention has been called, and which show horns or other amplifying devices made of paper or the like and directly associated with the needle or stylus, attention is called to the fact that these devices do not differ in character from the ordinary amplifying horn or sound-box, and are not per se vibratile tympanae, but mere amplifiers or condensers of sound waves. Furthermore, none of these prior art devices show any equivalent of a tympanum having its outer edge rigidly mounted in a support. In short, the horn-like reproducers are nothing more than the ordinary horn or amplifying megaphone having the stylus directly attached to its wall, so that the stylus sets up a localized vibration, which is confined within the flaring body of the horn and

amplified and reproduced as sound waves, not by any vibration of the horn as a whole, but merely by the condensation and amplification of the vibrations of the stylus and the portion of the material of the horn immediately adjacent the stylus connection."

In a subsequent amendment filed April 6, 1916, (Tr., 412) certain claims were cancelled, necessitating a renumbering of the remaining claims SO THAT THE CLAIMS IN INTEREST AT THIS POINT ARE NUMBERED 1, 2, *7*, *8*, *9*, *10*, *11*, *12*, *25*, *26* and *27*.

The application was then allowed, permitted to forfeit and was subsequently renewed.

In an amendment dated March 28, 1918 (Tr., 415) filed with the petition for renewal, claims *25*, *26* and *27* were cancelled. The solicitors said (Tr., 417):

"Claims *25*, *26* and *27* have been cancelled, as those claims will be incorporated, together with others, in a divisional application directed to the tympanum or diaphragm per se."

In a subsequent amendment dated April 18, 1918, instructions were given for amending claims 1, 2, *7*, *8*, *9*, *10*, *11* and *12* as follows (Tr., 419):

"In line 2, of each of present claims 1, 2, *7*, *8*, *9*, *10*, *11*, *12*, erase 'without an amplifying horn or chamber.' The matter to be erased is incorporated as an amendment in the communication filed February 23, 1916. Upon consideration, it appears that said matter is unnecessary to the claims from which it is erased."

In another amendment dated April 19, 1918, instructions were given for further amending claim *11* as follows (Tr., 421):

"Claim *11*, change line 6, as amended, to read,—an annular rim adjacent said support, the outer diameter of said rim exceeding nine inches, and a conical por-"

When the divisional application was filed (eventuating in patent No. 1,271,529) there were 13 original claims, claims 1 to 7 of which (Tr., 299, 300) correspond with claims 1 to 7 of the patent. Claims 8 to 11 and 13 were limited to a particular material for the tympanum. Claim 12 was as follows (Tr., 301):

"12. An acoustic device, comprising a tympanum freely exposed to unconfined air and comprising a conical portion upon the apex of which shocks or vibrations are adapted to be impressed in a direction such that said shocks or vibrations will move the entire conical portion bodily; said conical portion being of sufficient area to impart to the surrounding free air, when vibrated, sound waves substantially corresponding in intensity to the original shocks or vibrations."

This group of claims, namely, 8 to 13, inclusive, were cancelled by a subsequent amendment dated April 19, 1918 (Tr., 306). After the application was allowed on April 29, 1918 (Tr., 311) an amendment was filed on June 3, 1918, by which the following claim (claim 8 of the patent) was added in place of claim 12 (Tr., 308):

"8. An acoustic device, comprising a tympanum embodying a bodily movable, central conical portion, and an annular rim which encircles said conical portion and and which is rigidly supported, said conical portion being freely exposed on all sides to unconfined air and being of sufficient area to produce self-sustaining sound waves in the surrounding air when vibrated, substantially as described."